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Treatment of Urinary Incontinence

Megan D. Boyd
University of North Dakota

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TREATMENT OF URINARY INCONTINENCE

by

Megan Boyd
Bachelor of Science in Physical Therapy
University of North Dakota, 1997

An Independent Study

Submitted to the Graduate Faculty of the

Department of Physical Therapy

School of Medicine

University of North Dakota

in partial fulfillment of the requirements

for the degree of


Master of Physical Therapy

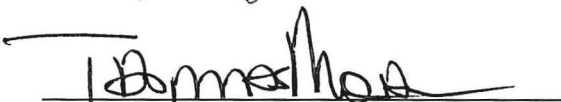
Grand Forks, North Dakota
May
1998



This Independent Study, submitted by Megan Boyd in partial fulfillment of the requirements for the Degree of Master of Physical Therapy from the University of North Dakota, has been read by the Faculty Preceptor, Advisor, and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.


(Faculty Preceptor)


(Graduate School Advisor)


(Chairperson, Physical Therapy)

PERMISSION

Title Treatment of Urinary Incontinence

Department Physical Therapy

Degree Master of Physical Therapy

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Date 2-27-98

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ABSTRACT

Urinary incontinence is a condition in which involuntary loss of urine is a social and hygienic problem and is objectively demonstrable, affecting around 13 million adult Americans. In the past, many people suffering from incontinence never sought help. They may have been too embarrassed to speak out, and instead, ultimately restricted their lifestyle in order to accommodate their incontinence or they were unaware that there is help available in their community.

The Agency for Health Care Policy and Research (AHCPR) established guidelines for the treatment of urinary incontinence in 1992 with an update in 1996. These guidelines state that, except in special circumstances, non-surgical treatment be attempted for the treatment of urinary incontinence before proceeding with surgery. Physical therapists possess the necessary combined knowledge and skills in kinesiology, electrotherapy, and exercise science to conservatively treat problems associated with urinary incontinence.

The purpose of this independent study is to outline an interdisciplinary approach for medical providers in the set up and treatment of a conservative urinary incontinence program. To accomplish this, the anatomy, physiology, and normal bladder function necessary for continence will be discussed. The pathology and types of urinary incontinence will also be reviewed. This will be

followed by a description of the different treatment options, their costs, and effectiveness.

CHAPTER I

INTRODUCTION

Incontinence is all too often a forbidden topic for discussion, and the fact that dictionary definitions of the word include 'lack of restraint' and 'lewdness' do not help. The International Continence Society's definition is more useful.¹ It states that 'Incontinence is a condition in which the involuntary loss of urine is a social and hygienic problem and is objectively demonstrable.' Incontinence is a condition that affects around 13 million adult Americans. That includes approximately 15% to 30% of community dwelling older people and at least one-half of all nursing home residents.¹⁻³ Among the population between 15 and 64 years of age, the prevalence of urinary incontinence in men ranges from 1.5% to 5% and in women from 10% to 30%.² Urinary incontinence is generally recognized as one of the major causes of institutionalization of the elderly. Among the 1.5 million nursing facility residents, the prevalence of urinary incontinence is 50% or greater, with the majority of those experiencing frequent urinary incontinence.

There is a persistent myth that urinary incontinence is a normal part of the aging process. Yet normal aging is not a cause of urinary incontinence, but rather, age-related changes in lower urinary tract function predispose a person to urinary incontinence in the face of additional anatomic or physiologic insults to

the lower urinary tract or by systemic disturbances such as illnesses common in older people.^{2,3} Women are twice as likely as men to be incontinent. Many women feel it is an inevitable result of childbirth and are accustomed to feeling “wet” and wearing absorbent pads and, therefore, more likely to accept it as normal. Men on the other hand are not accustomed to feeling “wet” and are more likely to seek treatment at an earlier stage. Most people believe little can be done and do not understand its causes or treatment options.

Urinary incontinence has many social and psychological barriers that affects the quality of a person’s life as well.^{2,4} Women with urinary incontinence can be depressed and embarrassed about their appearance and odor. This leads to social isolation. Because of this, 50% to 70% of the community dwelling people with urinary incontinence do not consult health care providers. When they do, it is reported and many physicians and nurses fail to pursue further investigation. It takes an average of nine years for a patient to seek help. If the physicians do not ask, the patient does not tell.

Urinary incontinence also has a major financial impact on society in general with over ten billion dollars per year spent managing incontinence in the United States alone.²⁻⁴ One third of all menstrual pads purchased are actually bought for urinary incontinence. The use of these pads may encourage some women to hide their urinary incontinence without seeking medical advice. Approximately half a billion dollars are spent annually on absorbent products for urinary incontinence. Therefore, it is very beneficial for an individual socially, psychologically, and financially to seek treatment for urinary incontinence.

The Agency for Health Care Policy and Research (AHCPR) was established in December 1989, under Public Law 101-239, to enhance the quality and access of health care services.⁴ Guidelines for detecting and treating urinary incontinence were completed in March 1992. The guideline panel defined incontinence as involuntary loss of urine that is sufficient to be a problem. The panel agreed that the guideline, which sought to improve the care of incontinent adults, should be directed toward acquired incontinence in ambulatory and nonambulatory patients in outpatient, inpatient, home care, and long-term care settings.² The 15-member panel of experts and lay people who wrote the guidelines mentioned physical and occupational therapy as important pre- and post-surgical considerations in the treatment of urinary incontinence in adults.⁴ Because the recommendations were so broad-based, AHCPR recommended updating the guideline, completed in 1996, to include recent literature and to provide specific recommendations for managing incontinence in adults. AHCPR provided the general parameters for this update of the guideline. The guidelines state that, as a general rule, the first choice should be the least invasive treatment with the fewest potential adverse complications that is appropriate for the patient. It also states that, except in special circumstances, non-surgical treatment be attempted for the treatment of urinary incontinence before proceeding with surgery. For many forms of incontinence, behavioral techniques meet these criteria.²

In the United States, conservative treatment for urinary incontinence has not been stressed in medical schools across the country. Therefore, many

practitioners are not aware that it works in spite of widespread data supporting its effectiveness.⁵⁻⁷ With the help of the AHCPR guidelines, conservative management of urinary incontinence is the wave of the future. Traditionally, gynecologists are taught to approach incontinence surgically. Today, physicians caring for incontinent women are treating enlightened consumers who are more willing to participate in their health care. For many, this includes a full discussion of their options for evaluation as well as treatment. As the problem of urinary incontinence grows, increasing national attention is directed at methods of evaluation and effectiveness of treatment of women and men with urinary incontinence.

This independent study will outline an interdisciplinary approach for medical providers in the set up and treatment of a conservative urinary incontinence program. To accomplish this, the anatomy, physiology, and normal bladder function necessary for continence will be discussed. The pathology and types of urinary incontinence will also be reviewed. This will be followed by descriptions of the different treatment options, their costs, and effectiveness. Finally, there will be the program proposal itself discussing the cost involved in set-up of equipment and education necessary for a behavioral treatment program and the revenues generated from treatments.

CHAPTER II

ANATOMY AND NORMAL BLADDER FUNCTION

More and more research is finding that dysfunctions in the pelvic floor complex can contribute to a variety of medical conditions, such as urinary incontinence, fecal incontinence, sexual dysfunction, pelvic relaxation, and levator ani syndromes. These problems are commonly under reported, embarrassing, and under treated. The symptoms from these dysfunctions may limit and interfere with a woman's (or a man's) ability to function in daily activities, change her/his exercise habits, or prevent participation in these activities. These pelvic floor dysfunctions are often preventable.^{7,8} To be able to treat any of these dysfunctions, in particular urinary incontinence, a good understanding of the pelvic floor anatomy and normal bladder function is required.

Anatomy of the Pelvic Floor Complex

The most common terminology used in reference to the pelvic floor is the "levator ani" or the "pelvic diaphragm complex." The anatomy of the pelvic floor is described differently by the surgeon than by the anatomist sometimes creating confusion as nomenclature has evolved. To study the anatomy as to the structure and function of the continence mechanism, the pelvic floor complex is divided into categories. In many texts, the "pelvic floor muscles" refers singularly to the levator ani muscles. However, the pelvic floor complex consists of five

layers of muscles and fascia attached to the bony ring of the pelvis. The superficial to deep layers are as follows: 1) The superficial outlet muscles (anal sphincter only). 2) The urogenital triangle (urogenital diaphragm, vaginal, and urethral sphincters). 3) The pelvic diaphragm (levator ani muscles). 4) The smooth muscle diaphragm. 5) The endopelvic diaphragm.^{6,8-12}

The perineum, the first two layers, can be divided into the urogenital triangle regions and anal triangle regions. These superficial external genital muscles form a figure of eight around the front passages (vaginal and urethral) and the back passage (anus). The anal triangle includes the external anal sphincter. The urogenital triangle includes the superficial transverse perineal, the bulbocavernosus (in the male, the bulbospongiosus), and the ischiocavernosus. These are illustrated in figure 1. The origins, insertions, and actions of these individual muscles are shown in Table 1.

The superficial transverse perineal muscle inserts into the perineal body and functions to brace the perineum against the downward pressure from the superior pelvic cavity. It has connections with the fascia from the levator ani and obturator internus muscles. The bulbocavernosus extends from the central tendon and inferior fascia of the urogenital diaphragm anteriorly to the suspensory ligament of the clitoris and is a constrictor of the introitus; it is sometimes referred to as the sphincter vagina.

Deeper in the urogenital triangle is the urogenital diaphragm formed by the deep transverse perineal muscle and the striated urogenital sphincters: sphincter urethrae, compressor urethrae, and urethrovaginal sphincter muscles.

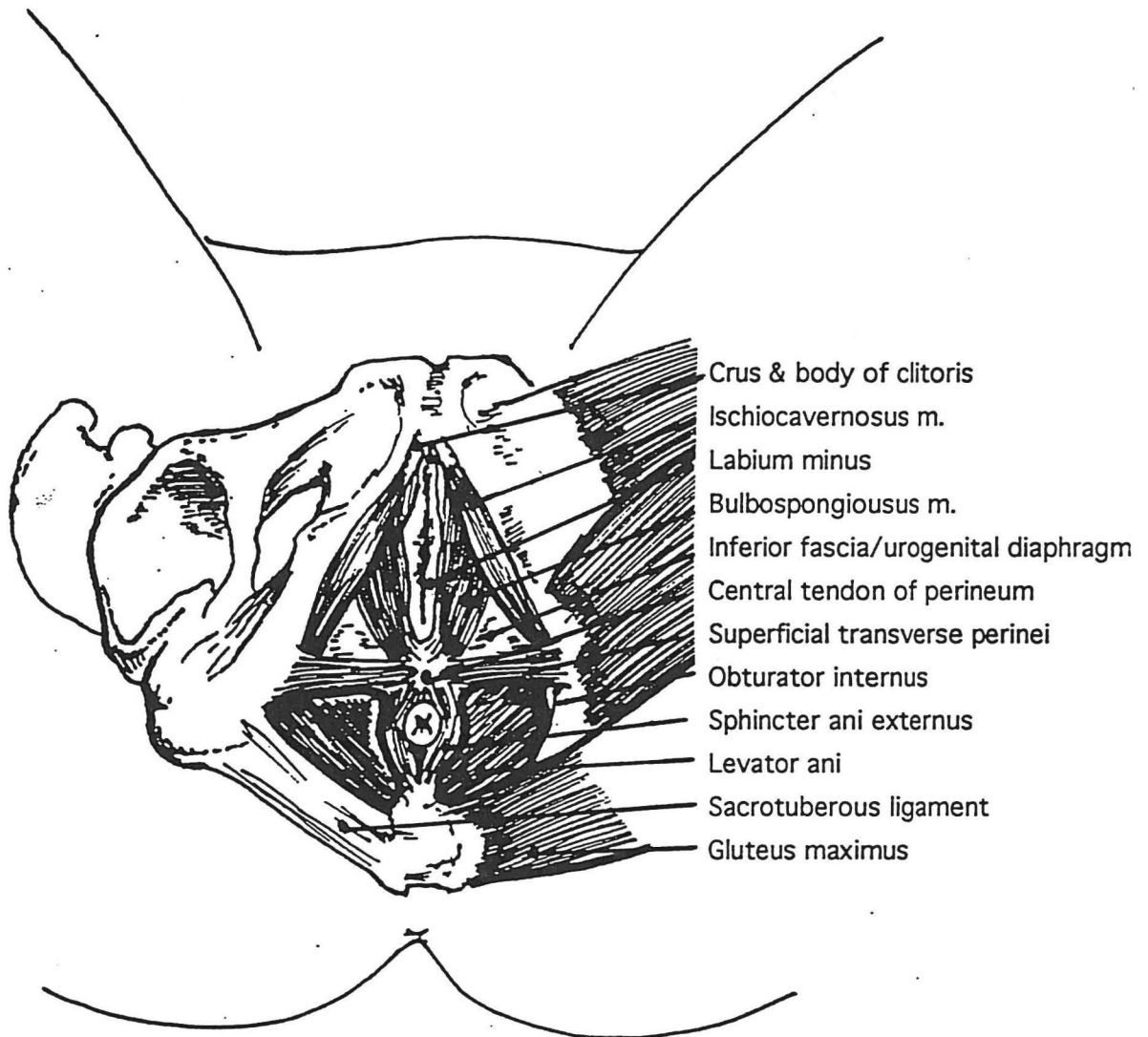


Fig. 1—Muscles of the perineum (inferior view).

Table 1.—Urogenital Diaphragm

Muscle	Origin	Insertion	Action
Superficial layer:			
Ischiocavernosus	Ischial tuberosity	Aponeurosis of crus clitoris	Erection of clitoris
Bulbocavernosus	Perineal body	Fascia covering corpus cavernosus	Vaginal sphincter & assists in erection of clitoris
Superficial Transverse Perineals	Ischial ramus	Perineal body	Fixes perineal body
Deep layer:			
Consists of perineal membrane and striated urogenital sphincter muscles			
Sphincter Urethrae	Pubic arch	Trigonal ring	Constrict urethral lumen
Urethrovaginal Sphincter	Vaginal wall	Ventral surface of urethra	Compresses ventral wall, assists incontinence mechanism
Compressor Urethrae	Ischiopubic ramus	Ventral surface of urethra	Compresses ventral wall, assists incontinence mechanism

This urogenital triangle is anterior to and more superficial than the pelvic diaphragm, oriented transversely with fascia that spans from the ischiopubic rami bilaterally.

Fascia plays an important role in the pelvic floor as it ensheaths the muscles and gives rise to most of the origins and insertions of those muscles. The fascial layer also ensheaths the pudendal nerve and accompanying vessels. Disturbances in the fascia can cause pain, muscle spasm, decrease range of motion, vasomotor changes, sweating, and weakness. Post surgical treatments and stretching and tearing during childbirth may damage fascial tissues.

The third layer, also known as the pelvic diaphragm or the levator ani muscles, is a group of striated muscles forming the deepest layer, which is laterally bordered by the tendinous arch (a thickening of the superior pelvic fascia covering the obturator internus muscle), the piriformis muscle, and the obturator internus muscle. The diaphragm is stretched like a hammock between the pubis in front and the coccyx behind and is attached along the lateral pelvic wall. The passage of the urethra, vagina, and anal canal creates a separation of the two halves of the diaphragm. The levator ani group is covered on both surfaces by fascia, derived from the transversalis fascia, which closes the pelvic cavity and assists in support of the abdominal and pelvic viscera. The anterior pubic portion of the levator ani muscles include the pubococcygeus, pubovaginalis, and the puborectalis. The posterior iliac portion includes the iliococcygeus. The pelvic wall portion of the complex is formed by the coccygeus, the obturator internus, and the piriformis. The fascia of the levator

ani group is continuous with these pelvic diaphragm muscles. This is illustrated in figure 2. The origins, insertions, and actions of the individual muscles are listed in Table 2. This pelvic diaphragm acts as a single neuromuscular unit to provide support for the pelvic viscera, tone for the vaginal walls, normal sexual functioning, and must also withstand the force of gravity as well as intra-abdominal pressure increases that occur with straining, lifting, and elimination of urine and feces. No fibrous connections are present between the pubococcygeus and the urethra, yet this muscle provides an occlusive force by fascial connection and anatomic proximity. Despite their significant functional role, the pelvic diaphragm is often poorly developed in women, particularly those with sedentary lifestyles and those who have gone through pregnancy and childbirth without attention to physical conditioning.^{6,8-12}

Pelvic floor exercise (Kegel exercises) are directed toward the pelvic diaphragm and are designed to strengthen and tone the pubococcygeus muscle. In actuality, however, voluntary contraction elicits a response in both the urogenital and pelvic diaphragms, thereby approximating the pubis and the coccyx and drawing the perineum inward.

In a comparative cadaver study performed by Zacharin¹² on the quality of the levator ani muscles in western and eastern women, it was demonstrated that eastern women present with greater muscle bulk, stronger support at the region of the bladder neck, more mobility, less deterioration of the muscle with age, and the ability to withstand greater intra-abdominal pressure. He attributes the differences to squatting, diet, genetics, and physical work.

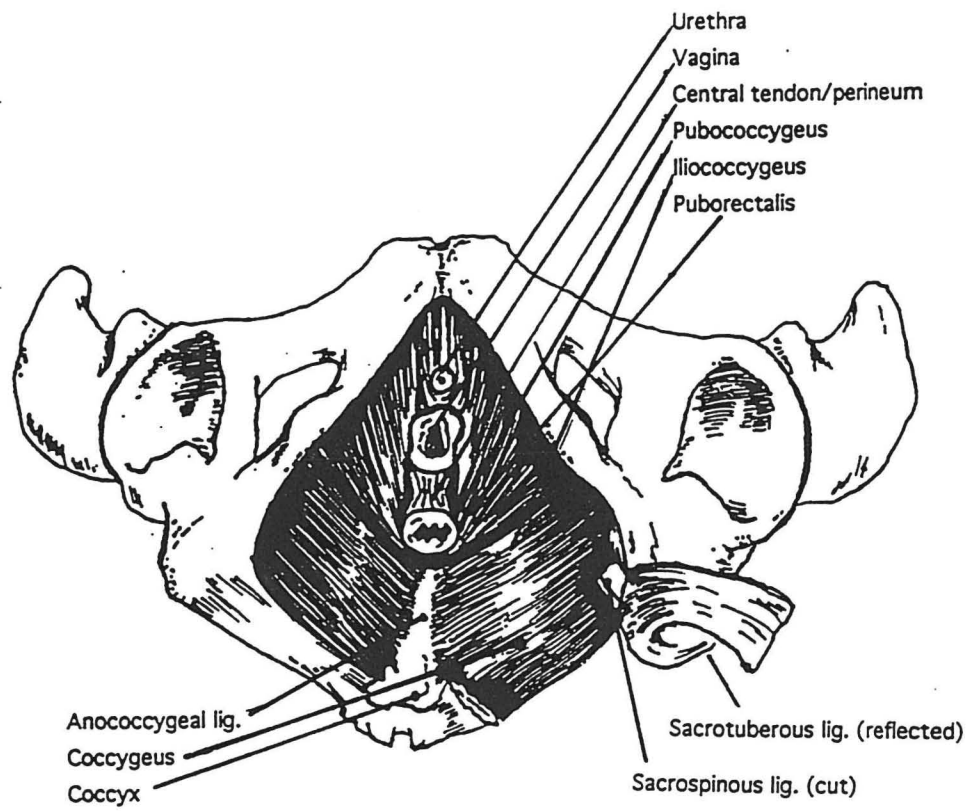


Fig. 2— Muscles of the pelvic diaphragm (inferior view).

Table 2.—Pelvic Floor Muscles (Pelvic Diaphragm)

MUSCLE	ORIGIN	INSERTION	ACTION
Levator ani			
Pubococcygeous	Dorsal surface of pubic bone & fascia or obturator	Anococcygeal body perineal body	Supports the pelvic viscera
Pubovaginalis	Medial & anterior portion pubic group	Perineal body	Sphincter of vagina & urethra
Puborectalis	Posterior portion of pubic group	Anococcygeal body	Loops around rectum, elevates and helps constrict anal canal
Iliococcygeous	Dorsal surface of pubic bone	Anococcygeal body & coccyx	Assists in support of pelvic viscera
Ischio-coccygeus	Spine of ischium	Caudal portion of sacrum/coccyx	Flexes coccyx, assists in support of pelvic viscera, & stabilizes the sacroiliac joint
Obturator Internus	Inner pelvic brim-obturator membrane, margin of obturator foramen	Medial surface of greater trochanter proximal to the trochanteric fossa	Lateral or external rotator of the hip
Piriformis	Pelvic surface of sacrum, margin of greater sciatic foramen & pelvic surface of sacrotuberous ligament	Superior border of greater trochanter	External rotator of hip, stabilizes the hip joint

Other key muscles to remember that play an important part in urogynecological dysfunctions are the abdominals, especially obliques and transverse, the adductors, iliopsoas, piriformis, obturators internus and externus, superior and inferior gemelli, quadratus femoris, and the diaphragm. These muscles need to be kept in mind when looking at the accessory muscles or substitutions of pelvic floor exercises.

Histology

There is controversy over the histology of the pelvic floor. The pelvic floor muscles are composed of fast and slow-twitch individual fibers, made up of two twitch types. These twitch types are determined by the predominant metabolic systems of the muscle fiber. This metabolic system is the chief determinant of muscle fatigability.

Slow-twitch type fibers (type I) are characterized by a high level of oxidative enzyme activity and are relatively fatigue resistant. They are presumed to be anti-gravity muscles and maintain tone and support the pelvic organs. Fast-twitch types (type II) are characterized by easy fatigability. These fibers are recruited during increased intra-abdominal pressure and appear to correlate with the speed and force of the levator ani contraction. They also work to facilitate rapid sphincter closure.^{6,8,13}

Anatomy of the Lower Urinary Tract

The lower urinary system consists of the bladder, the urethra, and the internal and external urethral sphincters. The bladder and urethra are a continuous unit that functions to store and evacuate urine. The bladder, also

known as the vesical or reservoir, has a three-layer wall consisting of a serous peritoneal covering on the outside, the muscular stratum known as the detrusor, and the inside mucous membrane. The detrusor muscle composes the majority of the bladder wall and forms the bladder and a portion of the bladder base and vesical neck. In the dome of the bladder, this muscle undergoes significant distention during filling. The base of the bladder is thicker than the dome and undergoes less distention during filling. This bladder base includes the region of the trigone and ureter outlets to the bladder neck. This trigone area has high adrenergic innervation.^{12,14-16}

The bladder neck, or vesical neck, is at the base of the bladder in the area of the internal sphincter. In the male, this is supported by the prostate gland and has smooth muscle with circular orientation. The prostate gland can function to support this area like a “bra.” In the female, this is supported by fascia and ligaments and has smooth muscle with longitudinal orientation. Poor fascia or ligamentous integrity can play into problems with incontinence, therefore leaving females more prone to problems with incontinence than males. After undergoing prostate removal, males may have increased problems with incontinence. Figure 3 illustrates a diagram of the bladder and urethra.

The urethra pierces the pelvic and urogenital diaphragms and the urogenital triangle. In the female, the length is 5 to 6 centimeters, and in the males, it is 18 to 20 centimeters and passes through the prostate. Current studies by Drees and Huisman¹⁵ have shown that the muscles of the trigone and urethra are separate from those of the detrusor. The muscles of these two

The three muscle layers of the bladder freely intermingle and are distinct only at the outlet. The muscle layer coating the urethra is oblique; the inner fibers are longitudinal.

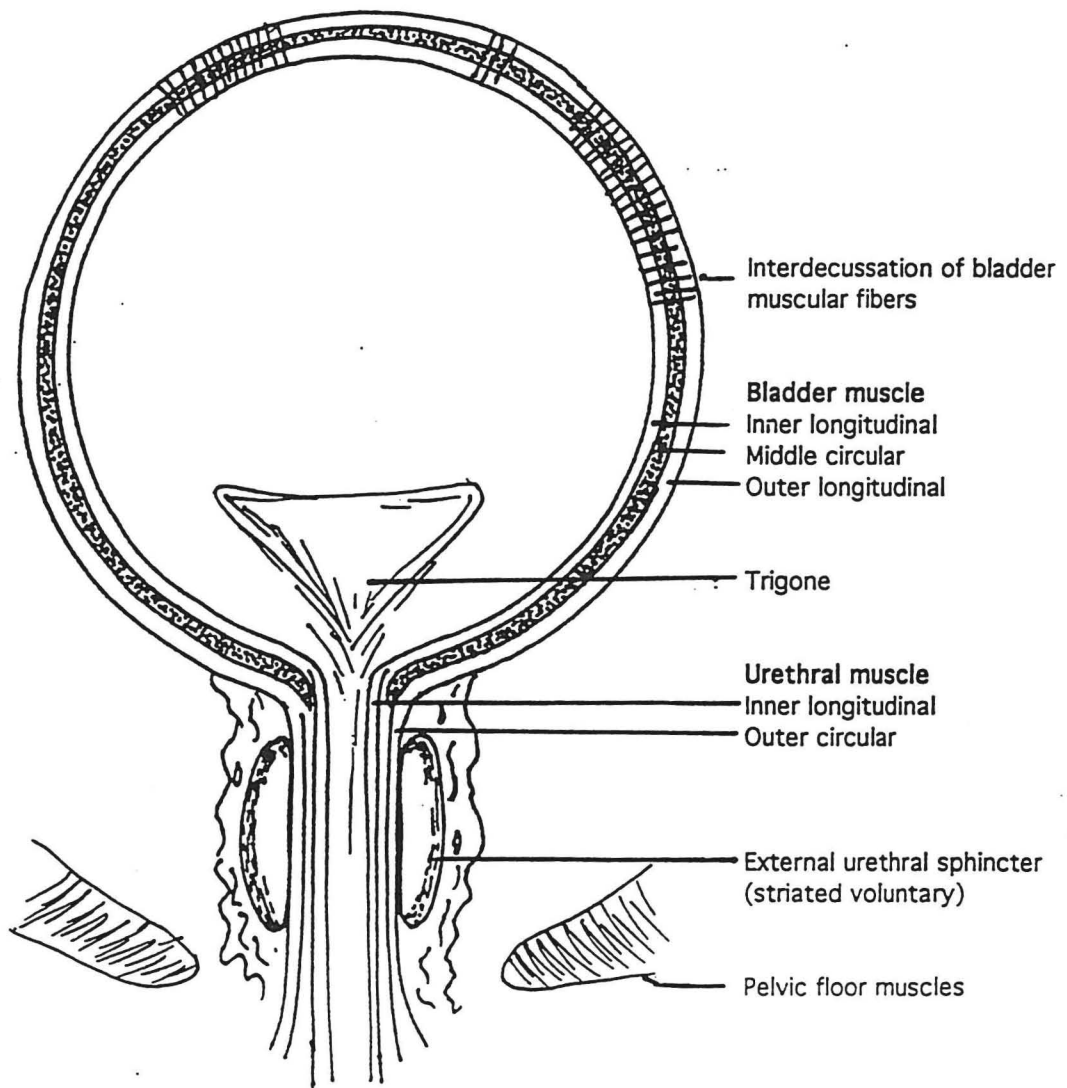


Fig. 3—Bladder and urethra

regions are very different in appearance and can easily be separated on microscopic examination. This division explains clinically why, when the bladder contracts, the trigonal ring and urethra must relax and vice versa.

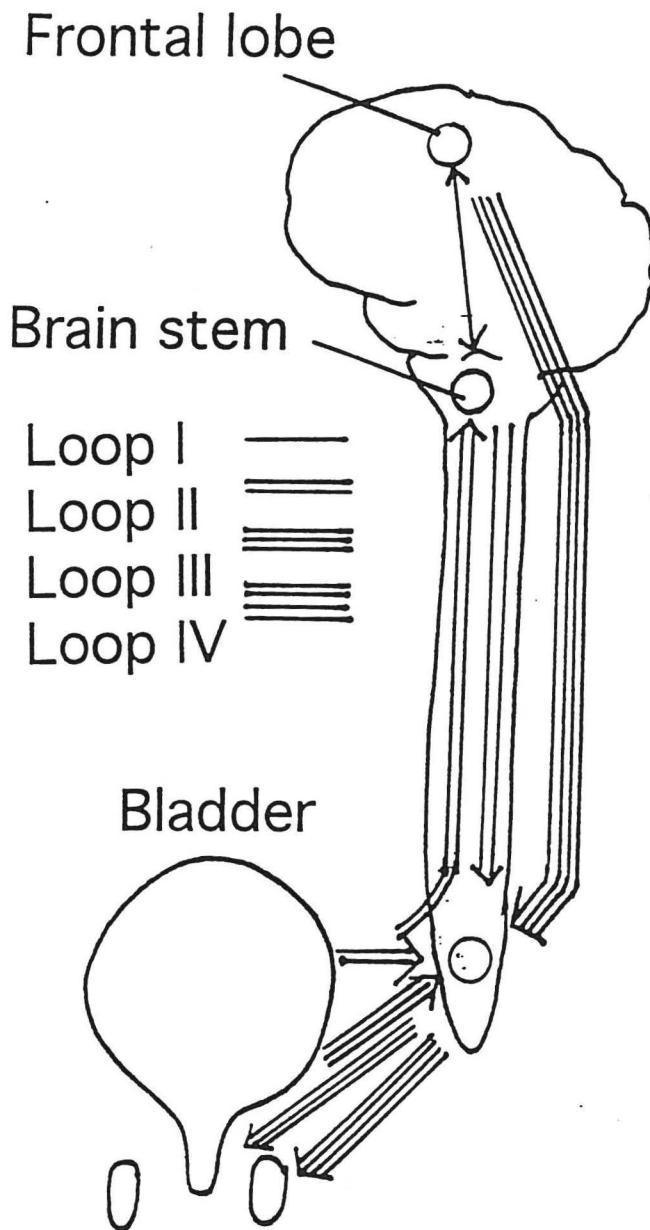
The urethral sphincter consists of striated muscle fibers made up of two portions surrounding the middle third of the urethra. The upper portion is called the striated urethral sphincter, also known as the rhabdosphincter, and the distal portion consists of the compressor urethrae and the urethrovaginal sphincter. The striated urethral sphincter is not a complete circle but inserts into the anterior portion of the trigone and works to constrict the lumen of the urethra. The compressor urethrae and urethrovaginal sphincter are disposed in such a way that they can close off the urethra by compression. These muscles are composed of slow twitch fibers and are well suited to maintaining constant tone while also being able to increase their activity under voluntary control to augment intraurethral pressure. The urethral sphincters cannot contract quickly enough to respond to a cough but can contract in preparation for a cough or during times of involuntary detrusor contraction and, therefore, they come into play as a back-up system to maintain continence.

Neurology of Bladder Function

We are not born continent. This is a learned behavior and must sometimes be relearned again later in life. The baby's bladder works on the reflex arc. It fills, the bladder stretches, and then it empties. The central nervous system cannot appreciate or voluntarily control this. As we get older, around the age of two, there is inhibition of the reflex arc. This requires an intact central and

peripheral nervous system. Four circuits, known as Bradley's Loops, provide cerebral neurologic connections and 12 reflexes control voiding. Afferent sensations of bladder distension and pain, and the knowledge that there is a socially acceptable time and place for voiding, modify this cerebral control.^{8,11,14-17} This is further illustrated in Figures 4 and 5.

In the frontal lobe of the brain, Bradley's Loop 1 works to have volitional control of micturition. This loop goes from the cerebral cortex to the brainstem and is known as the detrusor center. In the brainstem, pons, and reticular formation region, Bradley's Loop 2 is found. This loop goes from the brainstem to the sacral micturition area and provides a detrusor muscle contraction lasting long enough for the bladder to empty. Malfunction at this level impairs contractions. Since Bradley's Loop 3 is more complex, Bradley's Loop 4 will first be discussed. This is found in the frontal lobe of the cerebrum and runs to the sacral cord. This loop functions in volitional control of the internal striated sphincter keeping a constant tone during bladder filling. This loop can override Loop 3 and malfunction causes loss of voluntary contraction of the external urethral sphincter. Bradley's Loop 3 connects the detrusor muscle of the bladder to the sacral cord and the urethral sphincter. This coordinates detrusor contraction with sphincter relaxation. Therefore, if the pelvic floor and sphincters are contracted, a message is sent to the detrusor muscle in the bladder to relax. This loop plays an important part in electrical stimulation which will be discussed in the treatment section. Malfunction causes symptoms of obstruction, with hesitancy and prolonged voiding time.



Cerebral connections controlling micturition

Loop I, cerebral-brain stem circuit: Extends from frontal lobes to brain stem. Functions in volitional control of micturition reflex. Malfunction causes bladder to function autonomously.

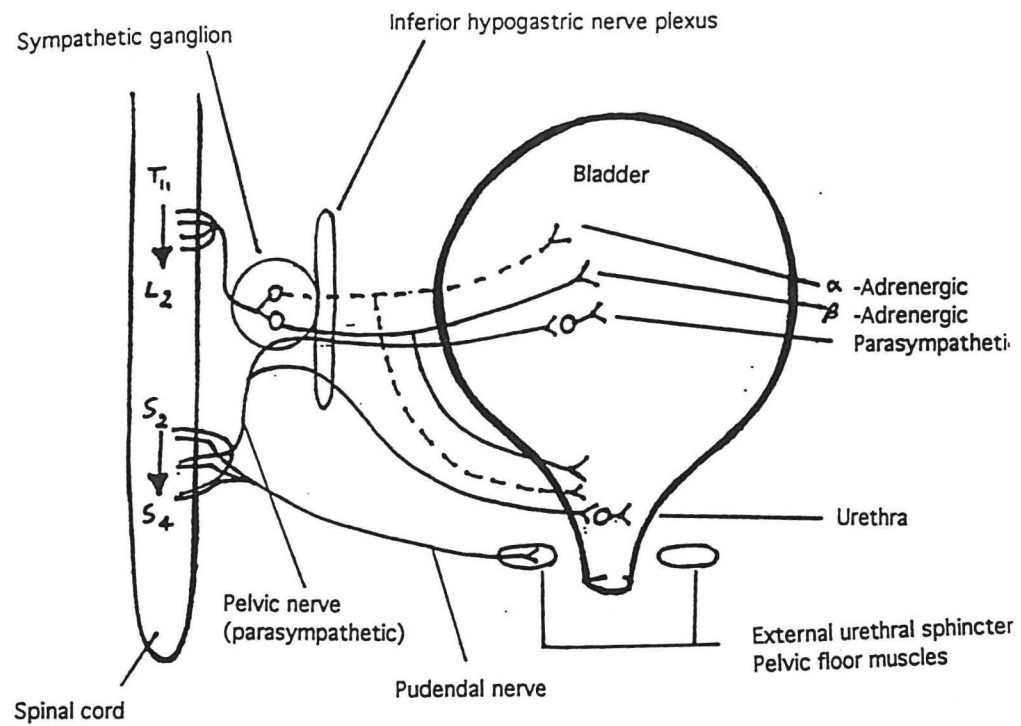
Loop II, brain stem-sacral loop: Passes from brain stem to sacral spinal cord. Provides a detrusor muscle contraction lasting long enough for bladder to empty. Malfunction impairs contractions.

Loop III, vesical-sacral-sphincter loop: Connects detrusor muscle, sacral cord, and urethral sphincter. Allows tonically contracted urethral striated sphincter to relax in synchrony with a detrusor contraction. Malfunction causes symptoms of obstruction, with hesitancy and prolonged voiding time.

Loop IV, cerebral-sacral loop: Passes from frontal lobes to sacral cord, and functions in volitional control of internal striated sphincter. Can override loop III. Malfunction causes loss of voluntary contraction of external urethral sphincter.

Four central nervous system loops or circuits provide neurologic connectors that control voiding.

Fig. 4—Cerebral connections controlling micturition



Motor supply to the bladder and urethra consists of a complex of sympathetic, parasympathetic, and somatic nerves.

Fig. 5—Motor supply to the bladder and urethra

In the spinal cord, there are two micturition centers, the spinal micturition and the sacral micturition center as referred to with Bradley's Loops. The spinal micturition center runs from T₁₁ to L₂, known as the hypogastric nerve, and is the sympathetic outflow. The sympathetic outflow has an alpha-adrenergic component, with fibers concentrated in the urethra, and a beta-adrenergic component, with fibers concentrated in the bladder. Alpha-adrenergic stimulation contracts the bladder neck and urethra and relaxes the detrusor, while beta-adrenergic stimulation relaxes the urethra and detrusor. This center inhibits micturition or could be said to stop and store urine. The sacral micturition center runs from S₂ to S₄. It has three components starting with Bradley's Loop 3 which was already discussed. The other two are the parasympathetic outflow, known as the pelvic nerve, which functions to promote bladder contraction during voiding and the somatic outflow, known as the pudendal nerve. This nerve innervates the pelvic floor muscles and can be contracted voluntarily which plays an important role when teaching pelvic floor exercises.

The events of continence can be broken down into three stages. The first stage is the bladder filling.^{12,14,16} The bladder has a normal capacity volume of 400 to 600 ml and is a low pressure reservoir. The first desire (urge) to void is usually felt around 150 to 250 ml. During this time, the bladder remains relaxed by parasympathetic blockade and the sphincter and pelvic floor contracts and retains a constant tone by alpha-adrenergic and Bradley's Loop 4. This stage is unconsciously controlled. The stage is the bladder transition in which the fullness of the bladder is recognized and the decision to void is made. In this

stage, a voluntary decision is made to postpone urination until we get to the bathroom. People with incontinence may void during this stage which could lead to smaller bladder capacities and, therefore, more frequent voiding is required. The third stage is the event of bladder emptying. This is voluntary. First, the detrusor muscle in the bladder contracts by parasympathetic outflow and the sphincter and pelvic floor relaxes, Bradley's Loop 3. After emptying the bladder, there is usually a post void residual of 0 to 50 ml and, therefore, leakage may occur with a cough or sneeze.

In summary, micturition represents a complex series of integrated central nervous system reflexes involving the lower urinary system, the pelvic floor and abdominal musculature, the spinal cord, the brain stem, and the cerebral cortex. Continence is based on the principle that urethral resistance must be greater than the intravesical pressure, a competent bladder neck, an intrinsic urethral mechanism, an intact external sphincter, an intact pelvic floor, intra-abdominal pressure, and an intact vascular content in and around the urethra. Continence also requires a relaxed urinary bladder during the collecting phase and permanent closure of the urethra, whereas at micturition, an intravesical pressure above the opening pressure of the simultaneously relaxing urethra has to be generated. These functions of the bladder and urethra are centrally coordinated and non-separable, although from a clinical point of view, it has been convenient to deal separately with storage and closure dysfunctions.^{12,14} Any disruption at any of the levels can lead to incontinence which will be discussed in the next chapter.

CHAPTER III

TYPES OF URINARY INCONTINENCE

Urinary incontinence can be caused by anatomic, physiologic, and pathologic (genitourinary) factors affecting the urinary tract, as well as external (nongenitourinary) factors. Multiple and interacting factors often contribute to urinary incontinence development, especially in frail, older patients. Several conditions that cause or contribute to urinary incontinence are potentially reversible. Therefore, it is important for the health care provider to understand the different types of urinary incontinence. The classification of subtypes of urinary incontinence can be based on symptoms. Understanding the subtypes provides a foundation for health care professionals to develop an effective treatment program.^{2,4,8,16}

Stress Incontinence

Stress incontinence, the most common type of the urinary incontinence, is the involuntary loss of urine that occurs following a sudden rise in intra-abdominal pressure brought on by coughing, sneezing, straining, laughing, or other physical activities in the absence of a detrusor contraction or an over-distended bladder. No single cause has been identified, but it is common in multiparous women as vaginal delivery brings about drastic changes in the anatomic position and shape of the pelvic muscles, viscera, and perineum.

Stretching, tearing, and attenuation of the fascia and muscles occur. The pudendal and pelvic nerves may become partially denervated by traction or entrapment, resulting in laxity of the perineal muscles and sphincters. The laxity of the pelvic diaphragm in women is a major contributing factor to urinary incontinence. This mechanism of leakage is known as hypermobility or failure of the extrinsic urethral support.^{2,4,8,12,18-22}

Failure of the extrinsic urethral support is the single most important variable in stress incontinence which can affect nulliparous as well as multiparous women. Kegel reported that 100 percent of clients with stress incontinence had some degree of difficulty contracting the levator ani muscles (also known as the pelvic floor). A survey by Beck¹² of women attending gynecologic clinics in Australia, Canada, and England revealed that 30% were troubled by stress incontinence and 40% of all clients could not voluntarily contract the pelvic diaphragm. Beck also reported that for 64% of women with stress incontinence, onset occurs during pregnancy and that half remain incontinent into the postpartum period. He also found stress incontinence to become progressive with subsequent pregnancies and the incidence of stress incontinence increases with the pregnant state.

Another mechanism of leakage in stress incontinence is the intrinsic urethral sphincter deficiency or weakness. This may be due to congenital sphincter weakness in patients with myelomeningocele, epispadias, or pelvic denervation, or may be acquired after prostatectomy, trauma, radiation therapy, or a sacral cord lesion. In women, intrinsic sphincter deficiency is commonly

associated with multiple incontinence surgical procedures, as well as with decreased levels of estrogen, aging, or both. In this condition, the urethral sphincter is unable to generate enough resistance to retain urine in the bladder, especially during stress maneuvers such as coughing, laughing, or lifting. Patients with intrinsic sphincter deficiency often leak continuously or with minimal exertion. In some patients, stress incontinence results from coexisting intrinsic deficiency and hypermobility of the urethra and bladder neck.

Urge Incontinence

Urge incontinence (also known as frequency incontinence) is a leakage of urine caused by an inability to delay voiding long enough to reach the toilet after an urge to void is felt. In this condition, the detrusor contracts at lower filling volumes and overrides the postponement phase. Various studies have reported that 10% to 15% of the adult population would appear to have some degree of impairment of voluntary control of the bladder. The most common case of this is detrusor instability.^{12,16,20-21,23}

To gain some insight into the cause of urge incontinence, it is necessary to consider some of the aspects of the normal neuronal control of micturition as discussed in the previous chapter. At bladder filling, the sensation of urge is mediated by slowly adapting mechanoreceptors in the bladder wall. The same receptors provide the triggering signal for micturition and the main driving force for a sustained micturition contraction. The mechanoreceptors are, technically speaking, tension receptors. When sufficiently activated, the mechanoreceptors may trigger a coordinated micturition reflex via a center in the upper pons

(Bradley's Loop 1, as discussed in Chapter II). The reflex detrusor contraction generates an increased bladder pressure and an even stronger activation of the mechanoreceptors. Their activity reinforces the pelvic motor output to the bladder, which leads to further increase in pressure and more receptor activation and the cycle continues. In this way, the detrusor contraction is to a large extent self-generating once initiated. Such a control mechanism usually is referred to as a positive feedback, and it may explain the typical all-or-nothing behavior of the parasympathetic motor output to the bladder. A great advantage of the positive feedback system is that it ascertains complete emptying of the bladder during micturition. A disadvantage with this system is that it may easily become unstable. Any stimulus that elicits a small burst of impulses in mechanoreceptor afferents may trigger a full-blown micturition reflex which explains the inability to voluntarily control the urge to void.

An intact distal urethral mechanism can compensate (Bradley's Loop 3, as discussed in Chapter II; contraction of the pelvic floor and sphincters and the detrusor will relax), but is often weakened in pregnancy, prolapse, and aging. Possible reasons for urge or frequency incontinence include increased stimulation of the detrusor due to infection or caffeine, bladder stones, diverticuli of the urethra and bladder, atrophic urethritis, vaginitis, chronic cystitis, urinary tumor, deficient inhibition of bladder function, outflow obstruction (more common in males), and fear of leaking. Neurological diseases, such as stroke, dementia, Parkinsonism, multiple sclerosis, and spinal cord diseases, can also cause urge incontinence.

It is important to distinguish urgency in which a person will void frequently but does not leak from urge incontinence in which leakage occurs. Urge incontinence can be precipitated by coughing, position change, and physical activity mimicking stress incontinence symptoms. Triggers, such as a key in the door, running water, or cold temperatures, can also cause trained responses in urge incontinence.

Another urodynamic diagnosis associated with the symptom of urge incontinence in frail, elderly patients is detrusor hyperactivity with impaired bladder contractility (DHIC).^{2,19} Patients with DHIC have involuntary detrusor contractions, yet must strain to empty their bladders either incompletely or completely. Clinically, patients with DHIC generally have symptoms of urge incontinence and an elevated postvoid residual volume, but they may also have symptoms of obstruction, stress incontinence, or overflow incontinence. DHIC must be distinguished from other types of urinary incontinence because it can mimic them, resulting in inappropriate diagnosis and treatment.

Mixed Incontinence

It is not unusual for patients to present with a combination of urge and stress incontinence. When both symptoms are present, the incontinence is called mixed urinary incontinence. Mixed urinary incontinence is common in women, especially older women. Often, however, one symptom (urge or stress) is more bothersome to the patient than the other. Identifying the most bothersome symptom is important in targeting diagnostic and therapeutic interventions.^{2,16}

Overflow Incontinence

Overflow incontinence is the involuntary loss of urine associated with over-distention of the bladder. This type of incontinence may have a variety of presentations, including frequent or constant dribbling, urge or stress incontinence symptoms, reduced urine stream, tenderness of the suprapubic region, and enlargement of the bladder. Overflow incontinence occurs with failure of the bladder to contract or with stricture of the urethral outlet causing an inability to void appropriately. This may be caused by an underactive or acontractile detrusor, or to bladder outlet or urethral obstruction leading to overdistension and overflow. The bladder may be underactive or acontractile secondary to drugs, neurologic conditions such as diabetic neuropathy, low spinal cord injury, or radical pelvic surgery that interrupt the motor innervation of the detrusor muscle. The detrusor muscle may also be underactive from idiopathic causes.^{2,4,12,16}

In men, overflow incontinence associated with obstruction is commonly caused by prostatic hyperplasia and, less frequently, prostatic carcinoma or urethral stricture. Although an outlet obstruction is rare in women, it can occur as complication of an anti-incontinence operation and because of severe pelvic organ prolapse in which the organ involved protrudes to or beyond the vaginal orifice.

Functional Incontinence

Urine loss may be caused by factors outside the lower urinary tract such as chronic impairment of physical or cognitive functioning, or both.^{2,3,19} This

condition is termed functional incontinence. This diagnosis should be one of exclusion, however, because some immobile and cognitively impaired individuals have other types and causes of urinary incontinence that may respond to specific therapies. Functional incontinence may be caused by immobility, which limits the patient's access to the bathroom to those times when assistance is available, or decreased mobility, which prolongs the time it takes to reach the bathroom. Certainly, unfamiliar surroundings, sight deficits, and lack of privacy compound the problem. Functional incontinence may also be due to lack of comprehension of or attention to the need to void, seen in some forms of dementia.

Urinary incontinence can often be improved or "cured" by improving the patient's functional status, treating other medical conditions, discontinuing certain types of medication, adjusting the hydration status, reducing environmental barriers, or all of the above. It also needs to be kept in mind that in an institutional setting, if an elderly patient is not expected to be continent, the motivation to stay dry decreases.

Incontinence affects 10 to 11 million people of all ages.^{2-6,19-21} Women are twice as likely as men to be incontinent. Denial is common and the average person waits between seven and nine years to seek help. Many women feel it is an inevitable result of childbirth and aging. Women are accustomed to feeling "wet" and wearing absorbent pads and are more likely to accept it as normal. Men, on the other hand, are not accustomed to feeling "wet" and, therefore, are more likely to seek treatment at a much earlier stage. Most people believe little can be done and do not understand its causes or treatment options. Because of

this, it is very important that primary health care providers should question and educate their patients regularly to identify urinary incontinence at an earlier stage.

CHAPTER IV

EVALUATION OF URINARY INCONTINENCE

Physician Evaluation for Incontinence

The key to treating urinary incontinence is to successfully sort out its many components. The most effective way to do this is through a basic evaluation consisting of a complete history, physical examination, estimation of post-void residual volume, and urinalysis. Risk factors that are associated with urinary incontinence should be identified and attempts made to modify them. The basic evaluation may not be appropriate for every patient, and every health care provider may not have the background to complete the entire assessment for all patients. At any time during the basic evaluation, the health care provider may refer the patient for further evaluation by a specialist.^{2,16,19,24-26}

The history should include a focused medical, neurologic, and genitourinary history that includes an assessment of risk factors such as medications, obesity, diuretics, smoking, low fluid intake, high-impact physical activities, estrogen depletion, and pelvic muscle weakness just to name a few. The history should also include a detailed review of medications, including nonprescription medications, and a detailed exploration of the symptoms of the urinary incontinence and associated symptoms and factors. Some of these factors are:

- ◆ Duration and characteristics of urinary incontinence (stress, urge, dribbling, frequency).
- ◆ Most bothersome symptoms to the patient (important in guiding therapy and determining response).
- ◆ Frequency, timing, and amount of continent voids and incontinent episodes.
- ◆ Precipitants of incontinence (e.g., situational antecedents, cough, certain types of exercises, surgery, injury, previous pelvic radiation therapy, trauma, new onset of diseases, new medications).
- ◆ Other lower urinary tract symptoms (e.g., nocturia, dysuria, hesitancy, poor or interrupted stream, straining, hematuria, suprapubic or perineal pain).
- ◆ Fluid intake pattern, including caffeine-containing or other diuretic fluids.
- ◆ Alterations in bowel habits or sexual function.
- ◆ Previous treatments and their effects on urinary incontinence.
- ◆ Expectations for outcomes of treatment.
- ◆ A bladder record or diary.
- ◆ A mental status evaluation and assessment of mobility, living environment, and social factors, especially in elderly patients.

One of the most helpful tools of the examination for the health care provider is the bladder diary. This plays an important part in the health care provider's ability to understand and assess the incontinence and later is used to

measure progress during treatment. The bladder diary should contain the following information: number of leakage episodes, number of pads used per day, frequency of urination, activities that cause leakage, fluid intake, urine output (in ml), and bladder irritants (e.g., caffeine, cranberry juice, etc.). An example of a bladder diary can be found Appendix A.

The physical examination should include a general exam to detect conditions such as edema that may contribute to nocturia and nocturnal urinary incontinence, neurologic abnormalities that may suggest multiple sclerosis, stroke, spinal cord compression, or other neurologic conditions.^{2,16} Mobility, cognition, and manual dexterity related to toileting skills among frail and functionally impaired patients should also be noted. The abdominal examination should include a check for diastasis rectii, organomegaly, masses, peritonitis, fluid collections, and so on. Abnormality of abdominal contents may influence intra-abdominal pressure and detrusor physiology. The rectal examination needs to test for perineal sensation, sphincter tone (both resting and active), fecal impaction, or rectal mass, and to evaluate the consistency and contour of the prostate in men. Genital examination in men is done to evaluate skin condition and detect abnormalities of the foreskin, glans penis, and perineal skin. In women, perineal skin condition, genital atrophy, pelvic organ prolapse (cystocele, rectocele, uterine prolapse), pelvic mass, paravaginal muscle tone, or other abnormalities are evaluated.

The last test of the physical examination should be a direct observation of urine loss using the cough test.^{2,3,16} Observation of urine loss can be performed

by having the individual cough vigorously while the examiner observes for urine loss from the urethra. Optimally, testing should be done when the patient's bladder is full but before the patient feels the urge to void. In women who are being evaluated for specific treatments for stress incontinence, this test is important for objective demonstration of urine loss and identification of provoking factors. In other patients, particularly those with physical or cognitive impairment, direct observation may be difficult to carry out, and this documentation may not be critical in determining initial treatment of incontinence. If an instantaneous leakage occurs with cough, then stress urinary incontinence is likely. If leakage is delayed or persists after the cough, detrusor instability should be suspected.

Basic screening tests used for diagnosing urinary incontinence are post void residual volume and urinalysis.^{2,16,24} Post void residual volume can be accomplished either by catheterization or by pelvic ultrasound. Post void residual volumes of less than 50 ml are considered adequate bladder emptying. Repetitive post void residual volumes ranging from 100 to 200 ml or higher are considered inadequate emptying. Clinical judgment must be exercised and all other clinical information included in interpreting the significance of post void residual volume, especially in the intermediate range of 50 to 199 ml.

A urinalysis is a test used to detect conditions that are associated with or contributing to urinary incontinence. If infection is present, a clean-catch urine sample should be obtained for culture and sensitivity tests. In women, when

urinalysis shows infections, a specimen should be obtained by catheterization to assure accurate test results.^{2,3}

The simplest means that will establish the cause of incontinence should be used. The tests described above in the basic evaluation are usually sufficient. Treatment is often then initiated without further investigation, provided it is inexpensive, involves minimal discomfort, is reversible, and has low risk. However, in situations where the diagnosis is elusive or treatment being considered involves significant morbidity, urodynamic testing should be performed.

For more complex testing in urodynamics, special equipment and advanced training is required. Some examples of this testing are cystometry, used to measure the bladder, and videourodynamics, using fluoroscopy to visualize the bladder. Urodynamic studies, however, carry a risk of infection and they should only be carried out when the result is likely to affect the management.

Physical Therapy Evaluation for Incontinence

After evaluation of anatomy and function of bladder storage and emptying has been completed, treatment decisions should be made based on the diagnosis. Physical therapy treatment has been found to be effective for the diagnosis of stress, urge, and mixed urinary incontinence. Once referred by a physician or allied health referral, physical therapists will then perform their own evaluation.^{2,3,8,16,27}

The evaluation will begin having the patient complete an intake questionnaire to provide information on the onset of the problem, chief complaints, and what aggravates/eases the symptoms. An example of this questionnaire can be found in Appendix B. Characteristics of the bladder symptoms will then be discovered through use of a bladder diary as discussed earlier. Abnormal storage, emptying, sensation, and contents will then be assessed from the bladder diary and the basic evaluation tests performed previously. A complete medical history will be taken, including a neurological history to find out concurrent problems, such as MS, CVA, spinal cord injury, or diabetes; cardiovascular disease (high blood pressure, edema, medications, etc.); medical problems that increase intra-abdominal pressure, such as COPD, smoking, allergies, obesity, and constipation; Ob/Gyn history of number of pregnancies, prolonged pushing, episiotomy, complications, or history of supportive dysfunction; surgical history of the pelvic region; and medications taken.

The next part of the evaluation is the pelvic floor muscle evaluation. There are three basic techniques to assess the pelvic floor muscles: the manual muscle test (internal exam), the functional stop test, and biofeedback. Proficiency in manual muscle testing requires detailed knowledge of muscle function, origin, and insertion. Agonistic and antagonistic muscle actions, particularly how these muscles function in fixation of skeletal structures and substitutions of suboptimal muscle groups, needs to be understood. Fundamental to this proficiency is the examiner's ability to palpate the muscle

and its tendon, assess its tone, assess normal and atrophied muscles, and recognize alterations in position and/or movement.

Manual Muscle Testing of Pelvic Floor Function

Testing should incorporate standard muscle assessment scales and differentiate between the state of the fast and slow-twitch muscle components. It should help formulate an individual exercise program. Digital internal palpation techniques require a woman to contract the pelvic floor muscles around an examining finger inserted vaginally. The evaluator feels for muscle symmetry, tone, sensation, and muscle atrophy in the anterior, posterior, left middle third, and right middle third of the vagina at the depth of the proximal interphalangeal joint of the finger. It is also important to palpate for the patient's ability to relax these muscles after a contraction. Other manual assessments evaluate the duration of the contraction, and the pressure and displacement of the examiner's fingers. Tables 3 and 4 show a detailed explanation of the grading used for manual muscle testing. Patients presenting with a normal or good grade are probably incontinent due to a medical condition other than pelvic floor weakness.

Functional Stop Test

A functional stop test of the pelvic floor musculature is a self-administered test. It is important to note that this technique is used for evaluation only, and should not be performed as an exercise because of its potential to disrupt the normal voiding reflexes and the theoretical risk of upper urinary tract infection secondary to urinary reflux.^{2,8,16} It should be performed a maximum of twice per month to assess changes in the muscle function. The test is performed while

Table 3.—Pelvic Floor Manual Muscle Testing, Wallace

		Wallace Descriptions
0	Zero	No palpable contraction
1	Trace	Flicker contraction
2	Poor	Contraction no lift
3	Fair	Palpable contraction and lift P > A
4	Good	Palpable contraction and lift with compression from UGT
5	Strong	Palpable lift and compression with inferior deflection of the MCP

Table 4.—Pelvic Floor Manual Muscle Testing, Laycock and Chiarelli

	Laycock	Chiarelli		e.g., 3/2/4/5
P	Power	Power	Represents the Power of the maximum voluntary contraction (MVC) and is graded 0 to 5	Muscle Power Grade Fair
E	Endurance	Endurance	Endurance is the time (up to 10 seconds) the MVC can be sustained	Fair Contraction Sustained 2 seconds
R	Repetitions	Repetitions	Relates to the number of Repetitions of the specific (timed) MVC. Rest interval = 4 seconds between repetitions	4 Repetitions of Fair Contractions Sustained 2 seconds
F	Fast Twitch	Fast Twitch	Denotes the number of Fast (1 second) contractions performed after a 2-minute rest	Able to perform 5 fat contractions after resting from endurance test
E	Every	Elevation		
C	Contraction	Cough		
T	Timed	Transcribe		

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sitting on a toilet. After urinating for five seconds, the subject attempts to stop the flow of urine for a maximum of one to two trials.

Utilizing this simple approach, a fair grade is defined as the ability to stop the flow of urine in a gravity-resisted position. For this patient, incontinence may occur as a result of increased intra-abdominal pressure. These additional forces, such as laughing, coughing, or lifting, distinguish these patients from a good or normal grade. A poor grade is indicated by the ability of the patient to maintain deflection of the flow of urine or a reduced stream of urine. A patient with a trace grade would be able to deflect or reduce the stream of urine but is unable to maintain this change, and the urinary stream would return to its normal flow and volume. Patients with no ability to change the flow of urine by deflection or volume are graded zero.

Biofeedback

The use of biofeedback with pelvic floor muscles began with Arnold Kegel in the 1930s to 1950s. He combined visual observation, digital assessment, and the pressure perineometer instrument to assess individual pelvic floor function and to guide patients in their exercises. Kegel applied feedback learning, essential for learning new motor skills, to assist with motivation and maintenance of an exercise program.^{2,8,16,28-30}

The perineometer is a simple, pneumatic apparatus consisting of a vaginal resistance chamber connected with a manometer calibrated from 0 to 100 mmHg. The perineometer is a pressure sensing device inserted into the vagina that provides numerical values and visual and proprioceptive feedback of

muscle contractions in the middle third of the vagina while performing a pelvic floor muscle contraction.

On the market today are similar devices, such as surface electromyography, as biofeedback that provides information about muscle events (not single motor units) and assesses the magnitude and timing of overall muscle contraction and relaxation with the objective of restoring normal physical function to a muscle. Computerized equipment with surface or internal (pressure) electrodes are available for assessment.

Musculoskeletal Evaluation

A thorough musculoskeletal examination of other key muscles that may play into urogynecologic dysfunctions should also be evaluated. These should include the abdominals, especially the obliques and transverse, the adductors, iliopsoas, piriformis, obturators, and the diaphragm. In addition, posture, gait analysis, body mechanics, and breathing need to be assessed while the patient is doing functional activities.

Evaluation and treatment of the patient with urogenital dysfunction challenges the physical therapist to apply knowledge of anatomy, neurophysiology, pathology and kinesiology to urologic, gynecologic, obstetric, and orthopedic conditions. Therefore, performing a thorough evaluation paying careful attention to detail and following each step will allow the physical therapist to better design a treatment program to meet the individual needs of each patient.

CHAPTER V

TREATMENT OF URINARY INCONTINENCE

Individuals with urinary incontinence need to have their treatment options, including risks, benefits, and outcomes, discussed in detail with them so that informed choices can be made. In the recent past, it was generally accepted that the most appropriate treatment of severe urinary incontinence was surgical. However, the management of mild to moderate incontinence was less certain and there were some patients for whom surgery was inappropriate; for example, those unwilling or not medically fit for surgery and women who plan for future pregnancies, since later vaginal deliveries may adversely affect successful surgery. Therefore, there is a place for conservative treatment of urinary incontinence and physical therapy is one of the most effective.

The benefit of conservative treatment has recently come to the forefront. The 1996 AHCPR guidelines recommends the first choice treatment should be the least invasive treatment with the fewest potential adverse complications that is appropriate for the patient. For many forms of urinary incontinence, conservative treatment, specifically behavioral techniques and pelvic floor reeducation practiced by physical therapists, meets these criteria. When behavioral techniques do not achieve the desired result, other treatments such as pharmacological or surgery may be initiated.^{2,19,31-32}

Physical Therapy Treatment For Urinary Incontinence

There are six main areas that physical therapy addresses in treating urinary incontinence and will be discussed as follows: patient education, bladder training, pelvic floor muscle exercise, electrical stimulation, and functional activity training.

Patient Education

The first step in treating urinary incontinence is patient education. It is very important that the patient understand the normal function of the lower urinary tract, dietary and fluid management, and behavioral techniques so that they are better prepared to take an active role in their treatment.^{2,7,16} There are several key points that the patient needs to be taught regarding the normal urinary function:

- ◆ The bladder is a storage area and control of urination is a learned behavior, not one with which we are born, and therefore, sometimes must be learned again.
- ◆ No pushing or straining is necessary for voiding. It is important to relax and take your time while voiding to allow the pelvic muscles to relax and the detrusor to contract.
- ◆ The first urge to void is felt at approximately 150 ml (or 5 oz.) and most people can and should delay voiding. Failure to do so may decrease bladder capacity.
- ◆ If fluid intake is normal and no infection is present, a person should be able to wait two hours after the first urge to void is felt.

- ◆ Normal voiding amounts are approximately 200 to 300+ ml (or 10+ oz.) per day and 12 to 20 oz. at night.
- ◆ Awareness and knowledge of function of the pelvic floor muscles.
- ◆ To avoid valsalva maneuvers and bearing down on the pelvic floor so as not to in effect “deliver” the bladder by increasing intra-abdominal pressure.

Dietary and fluid management needs to be addressed because certain foods and fluids, or lack of, can contribute to urinary frequency, urgency, and discomfort. The patient needs to be educated on the importance of a fluid intake of 1,500 to 2,000 ml per day, avoiding intake several hours before bedtime.^{7,16} If not enough fluid, especially water, is taken in each day, the urine can become concentrated leading to bladder urgency, a foul odor, and can cause urinary tract and skin infection. Some common bladder irritants are alcoholic beverages, coffee, tea, highly spiced foods, and cigarette smoking. A more complete list of some dietary irritants and suggestions or substitutions that can be made can be found in Appendix C.

The third part of patient education is behavior techniques. Behavioral techniques increase the patient’s awareness of the lower urinary tract and environment and can enhance control of detrusor and pelvic muscular function. Such techniques are relatively noninvasive, generally free of side effects, and do not limit future options. They do require time, effort, and continued practice. These can be divided into two categories, caregiver-dependent techniques for

patients with cognitive and motor deficits, and those requiring active rehabilitation and education techniques.^{2,3,7,16,20}

Caregiver -dependent techniques manage symptoms rather than restore function. These consist of scheduled toileting, habit training, and prompted voiding at regular intervals. Scheduled toileting is on a timed basis of every two to four hours including at night. This technique is recommended for patients who cannot participate in independent toileting. The goal is to keep the patient dry. No systematic effort is made to motivate the patient to delay voiding and resist urge, unlike in bladder retraining. Habit training is toileting scheduled to match the patient's voiding habits. This is recommended for patients for whom a natural voiding pattern can be determined and is an excellent technique for patients who live at home with a caregiver.

For patients who may not have sufficient cognitive ability to participate in other, more complex behavioral therapies, prompted voiding is recommended. These patients can learn to recognize some degree of bladder fullness or the need to void, or can ask for assistance or respond when prompted to toilet. There are three major elements of prompted voiding: monitoring, in which the patient is checked by caregivers on a regular basis and asked to report verbally if wet or dry; prompting, in which the patient is asked to try to use the toilet; and praising, in which the patient is praised for maintaining continence and for trying to toilet.

For the patients who are able to actively participate in their treatment, the behavioral techniques include bladder training, which will be discussed in detail

in the next section, use of postural changes, or use of a tampon or pessary device. Some patients have discovered postural changes, such as crossing one's legs or bending over upon sneezing or coughing, an effective and socially acceptable way of dealing with stress incontinence. Temporarily wearing a vaginal tampon or a contraceptive diaphragm during exercise can also reduce urinary incontinence, especially if urine loss is associated with aerobic exercise. The mechanism of decreased leakage is thought to be due to reduction of bladder neck mobility.⁷

Bladder Training

Bladder training or retraining is used for the patient who can actively participate and is motivated. This is a mandatory scheduled voiding with progressive increases in the intervals between voiding. Cognitive function, cooperation, pelvic muscle awareness and strength, and ambulatory status is required. This is used with stress, urge, mixed incontinence, "just in case" voiding, or for sensory urgency without incontinence. The goal is to increase bladder capacity and decrease urgency. There are three main components of this program: education, as previously discussed, scheduled voiding with systematic delay of voiding, and positive reinforcement.^{2-4,7,16,19,20}

For scheduled voiding with systematic delay of voiding, the patient is asked to resist or inhibit the sensation of urgency, to postpone voiding, and to urinate according to a timetable rather than according to their urge to void. The timetable usually begins in one hour intervals, but can begin as frequently as 15 to 30 minute intervals, depending upon the patient's current voiding schedule.

When the urge to void arises, the patient is asked to take two deep breaths, think about something else as a distraction technique, contract their pelvic floor muscles, wait ten minutes, slowly rise, and walk to the bathroom. It is thought that rushing to the bathroom can also create contraction of abdominal muscles, which can contribute to the contraction of the detrusor muscle. The goal is to train the bladder to hold increasing amounts of urine, and eventually for the patient to be able to void every three to four hours. A bladder diary can facilitate documenting amounts of urine and tracking fluid intake. A home instruction guide for bladder retraining for patients can be found in Appendix D.

Pelvic Floor Muscle Exercise

The first person to investigate pelvic floor muscle strengthening was Arnold Kegel; therefore, the pelvic floor muscle exercises have come to be called “Kegel exercises.”^{4,6,18,30,33} He used a measuring device called a perineometer similar to biofeedback methods used today. Many studies have shown pelvic floor exercises to be successful in strengthening the pelvic floor and in treating stress, urge, and mixed urinary incontinence. He reported a cure rate of 84% for stress urinary incontinence.^{30, 33} Very little activity in this field followed this first presentation. However, during the last decade, there has been a renewed interest for this treatment method.

Pelvic floor muscle strengthening improves continence in two ways. First, strengthening the striated urogenital sphincter enhances the ability to constrict the urethral lumen. This increases the resting pressure in the urethra, which then increases the amount of pressure generated in the urethra during a cough,

sneeze, or other activity. Second, because the levator ani muscles are important to pelvic and urethral support, pelvic floor exercises improve the support of the proximal urethra and stabilize the bladder neck. The short term training effect of pelvic floor muscle strengthening is neural adaptation; more motor units are learning to fire. The long term effect is muscle hypertrophy.

The first step in teaching pelvic muscle strengthening is to establish better awareness of pelvic muscle function. Pelvic muscle exercises are performed by “drawing in” or “lifting up” the perivaginal muscles and anal sphincter as if to control urination or stop a bowel movement with minimal contraction of abdominal, gluteal, or adductor muscles. The patient is asked to hold for as long as he/she can, one to ten seconds, and then to relax completely before the next contraction.

Pelvic floor exercises can be done following simple verbal commands. However, Kegel originally observed that approximately 40% of women were unable to perform exercises properly under these circumstances due to lack of awareness.^{4,30,31} There are some special challenges of teaching pelvic floor exercises, such as a lack of a woman’s awareness and knowledge about the perineum, a modesty level, and preconceived ideas about the perineum, psychosocial affects of previous abuse or trauma, the length of time of disuse of these muscles, lack of proprioception during contraction, scar tissue limiting contractile properties of skin and muscles, and pain inhibiting muscle contraction.

Women can be taught how to identify their pelvic muscle during the vaginal examination in which the examiner will perform a digital examination

using the index and middle finger. The examiner instructs the woman to pull in her vagina or to “squeeze my fingers” to determine the strength of the muscle. In men, the examiner assesses the pelvic muscle by digitally examining the rectal sphincter while asking the patient to tighten his anus. During this examination, the physical therapist takes the time to teach the patient the correct identification and contraction of the muscle and provides verbal feedback to ensure accurate practice. Isolation from abdominal, gluteal, and adductor muscle contractions is important because these may mask the pelvic floor contraction and tire the patient. A step-by-step instruction sheet for teaching pelvic floor exercises can be found in Appendix E.

Biofeedback can be used to reinforce pelvic floor exercises and behavioral changes in patients with urinary incontinence and is an effective way to enhance physical therapy training in women with urinary incontinence or unstable bladder.^{1-3,6} Visual or auditory feedback allows the patient to see the rise in urethral pressure from tightening the pelvic floor muscles or hear the increase in electromyographic activity being recorded. After training, successful patients typically learn to perform the correct responses relatively automatically. Patients with urinary incontinence are trained to relax the detrusor and abdominal muscles and/or contract the sphincter, depending upon the form of incontinence. When used in patients with stress and/or urge incontinence, biofeedback has been shown to result in complete control of incontinence in approximately 20% to 25% of patients and to provide important improvement in another 30%.^{2,6} Burgio et al³⁴ compared the effectiveness of pelvic floor exercise

using verbal feedback to using biofeedback and found that the biofeedback group had a 76% reduction in urinary incontinence and the verbal feedback group a 50% reduction. Susset³⁵ found that biofeedback training in patients with low urethral pressure resulted in continence in 80% (12 of 15) of women.

Maybe one of the important factors in success in biofeedback is that the patients view themselves as “in charge,” which results in a sense of accomplishment. The job of the therapist is to encourage a sense of control and maintain high incentives for the patient to continue with the home program. Some specific objectives for treating the pelvic floor muscles with SEMG and graphs will be included in Appendix F.

Another method for providing sensory feedback as well as a graded strengthening technique is the use of vaginal cones.^{1,2,8,16} The cones come in sets of five, beginning with 20 grams and progressing to 100 grams each. The suggested technique for exercising with the cones is to have the patient place it inside the vagina and walk with the cone in place for 15 minutes, two times a day. Longer than 15-minute periods is not recommended because that may encourage chronic muscle holding patterns. Use of cones by women with very weak pelvic musculature may be frustrating, as they may be unable to hold the cone in place. Muscle assessment is recommended prior to using the cones to avoid discouraging patients.

A study by Peattie et al³⁶ reported a 70% cure or improvement of women with stress urinary incontinence out of 30 patients using cone training for one month. Bridges et al³⁷ compared cone therapy with intravaginal stimulation

(≤ 100 Hz for 15 minutes, three times per week). After four weeks, the cone group showed 78% improvement ($n = 24$) and the stimulation group ($n = 30$) showed 90% improvement; no control group was used. The authors concluded that cone therapy is an important first approach to stress urinary incontinence because it does not require the intensive physiotherapy that stimulation therapy does. Thus, the cost to the health care system is considerably less.

Cone therapy can be performed by the patient at home without disrupting home life and offers an easy method of distinguishing the use of pelvic floor muscles from abdominal wall contraction, as raised intra-abdominal pressure will enhance the downward force of the cone on the pelvic floor, increasing the exercise effect.

Electrical Stimulation

Electrical stimulation is another method of enhancing muscle contractions and decreasing urinary incontinence. The symptoms of stress incontinence can be significantly decreased by strengthening the striated musculature of the pelvic floor, therefore increasing urethral pressure.^{5,8,23,38} This is done when intravaginal electrical stimulation activates the pudendal nerve motor efferents, causing contraction of the pelvic floor musculature, which the patient perceives. This passive contraction helps to reeducate the patient to exercise correctly. Temporary hypertrophy and strengthening of the pelvic floor skeletal muscle affected by electrical stimulation may be sustained following treatment if the patient continues routine, correctly performed pelvic floor exercises. The

recommended parameters of electrical stimulation for strengthening the pelvic floor is 35 to 50 Hz.^{16,23}

For decreasing symptoms of urge incontinence, the use of electrical stimulation causes contraction of the pelvic floor musculature which has a reflex inhibitory effect on detrusor activity. Voluntary contraction of the pelvic floor is normal protective behavior that can suppress the inconvenient urge to void. When using a different parameter of electrical stimulation of 5 to 20 Hz, bladder inhibition is induced for the patient with detrusor instability.^{16,23,38} The reflex spinal mechanisms responsible for this phenomena activate, via pudendal afferents, hypogastric (sympathetic) inhibitory neurons and inhibit pelvic (parasympathetic) excitatory neurons to the detrusor. Defective inhibitory neuronal pathways may be the cause of idiopathic detrusor instability. Electrical stimulation may improve this condition by regenerating the defective inhibitory pathways or reinforcing other inhibitory mechanisms.

Studies have shown an improvement in patients with stress urinary incontinence, urge (detrusor instability), and mixed incontinence. A study by Caputo et al³⁸ reported an overall objective improvement rate in patients after six weeks of electrical stimulation of 76%. By type of incontinence, the objective improvement rate was 89% for stress incontinence, 73% for urge incontinence (detrusor instability), and 70% for patients with mixed incontinence. In another study by Bent et al,³⁹ electrical stimulation, self-administered for 15 minutes twice daily for six weeks, showed a subjective success rate based on a questionnaire

at 71% for genuine stress incontinence, 70% for urge (detrusor instability), and 52% for mixed urinary incontinence.

In another study by Dumoulin et al,⁴⁰ the use of interferential currents with pelvic floor reeducation indicated that maximum pressure generated by pelvic floor contraction was greater, and both the quantity of urine loss and the frequency of incontinence were decreased following the implementation of the physical therapy program. Five subjects became continent, and three others improved out of eight total subjects.

Functional Activity Training

It is important that physical therapists use their extensive knowledge for teaching proper body mechanics and review the body mechanics of activities that can cause leakage. Activities such as getting out of bed, coming from sit to stand and lifting need to be performed with optimal posture and contraction of the pelvic floor simultaneously to be able to prevent leakage. It should be discovered during the physical therapy evaluation if the patient has adequate strength and range of motion to be able to perform these correctly. To meet the therapeutic goals of being continent, the patients need to be able to demonstrate carryover of performing the pelvic floor muscle contractions into their activities of daily living. To do this, it is important that the patient be taught diaphragmatic breathing versus doing a valsalva maneuver and to coordinate the pelvic floor contractions with activities that cause leakage. This will in effect give a “perineal lock” to facilitate the ability to voluntarily prevent leakage.^{8,16} Early in the

treatment process, the exercises need to be incorporated into the patient's daily regimen of activities.

In summary of the physical therapy treatments, pelvic muscle reeducation is a safe, effective, conservative therapy for patients with urinary incontinence. The success of the method depends on the proper selection of patients and the active participation of a cooperative patient. However, it is of limited use in patients with cognitive impairment. The methods explained earlier for behavioral techniques in treating caregiver-dependent patients can be used in those cases. The role of the physical therapist would then be important as an educator.

Pharmacological Treatment For Urinary Incontinence

For treating stress incontinence, the most common form of urinary incontinence, a drug that increases urethral resistance should be used.^{2,16-17,25} These include alpha-sympathomimetics (ephedrine, sudafed, dexatrim, tofranil) and estrogens. Several studies, with alpha-adrenergic stimulating drugs with or without estrogen, indicate an increase in urethral closure pressure together with symptomatic improvement.¹⁷ Rarely, however, can complete continence be achieved with pharmacologic agents alone, and the therapeutic effect is often reversed when the drug is withdrawn. Side effects are relatively mild and include blood pressure rise, anxiety, and insomnia.

During the last decade, clinical investigations have illustrated the mechanisms through which estrogens affect the lower urogenital tract. Estrogens stimulate maturation of the urethral epithelium and produce a significant increase in blood flow through the urethral and periurethral vascular

bed. It has been shown that the urethral vascular bed contributes up to 30% to the intraurethral pressure. Therefore, the increased vascularization of the tissue within the urethral wall will considerably enhance the intraurethral resistance and thus improve the 'sealing' mechanism of the inner urethral wall. In addition to the effects on the urethral vascular bed, estrogens appear to increase the sensitivity of the alpha-adrenoreceptor within the urethral wall. These findings indicate that estrogens play an important role in the function of the lower urinary tract.

For an unstable or overactive detrusor, as seen in urge incontinence, anticholinergics (propantheline, flaxovate, dicyclomine, imipramine, oxybutynin, hyoscyamine sulfate) should be used.^{2,16-17} Anticholinergic drugs produce an effect on the bladder and the urethra by decreasing the amplitude and the frequency of involuntary detrusor contractions and increasing bladder capacity; therefore, the symptoms of frequency, urgency, and nocturia are reduced. Side effects of anticholinergic drugs are common, such as headaches, sweating, tachycardia, hypertension, and insomnia, but can be minimized if low doses are given.

Overflow incontinence is caused from an underactive bladder muscle, decrease in bladder muscle tone, or restricted flow from an enlarged prostate. Drugs which may be prescribed to control overflow incontinence are: 1) bethanechol to improve bladder contractions, 2) clonidine to decrease urethral pressure, and 3) dantrolene and prazosin to relax bladder outlet muscles.

Pharmacological therapy can be used by itself or in conjunction with other therapeutic treatments, such as conservative non-surgical techniques or surgical

techniques. Several medications have proven to be beneficial for treating urinary incontinence, although their risk-to-benefit ratios are difficult to gauge precisely because of deficiencies in study design. A more complete list of specific medications and studies to show their efficacy can be found in the AHCPR 1996 clinical practice guidelines.

Surgical Treatment For Incontinence

According to the 1996 AHCPR treatment of urinary incontinence guidelines, the decision to perform surgery for the treatment of urinary incontinence should be made only after a precise, focused assessment.² This should include a comprehensive clinical evaluation with an objective confirmation of the pathophysiologic diagnosis and severity of urinary loss, a correlation of the anatomic and physiologic findings with the surgical plan, an estimation of surgical risk, and an estimation of the impact of the proposed surgery on the patient's quality of life.

The objectives of surgical treatment of incontinence depend on the specific etiology; however, a given patient may have more than one etiology. The purpose of a surgical procedure is to correct, compensate for, or circumvent the underlying pathology causing urinary loss. Surgical procedures that address these underlying pathologies are divided into three sections. Stress incontinence in women may be caused by urethral hypermobility or intrinsic sphincter deficiency. Men with stress incontinence suffer solely from intrinsic sphincter deficiency. Therefore, surgeries that increase outlet resistance and relieve stress urinary incontinence and intrinsic sphincter deficiency are performed. For

inappropriate elevations in bladder pressure resulting from uninhibited bladder contractions or a loss of bladder compliance, like that seen in urge incontinence, procedures that decrease detrusor instability and correct urge incontinence are performed. For poor bladder emptying that leads to retention resulting from an impaired or absent bladder contraction or from outlet obstruction, operations that remove outlet obstruction, thereby correcting overflow incontinence or reversing detrusor instability that is secondary to the outlet obstruction is accomplished.

Standards have not been established for describing the patient population, the type of incontinence, the methods for accurate diagnosis, the techniques of the surgical procedure, or the outcome in different domains, such as symptoms, anatomic/physiologic outcomes, quantity of fluid loss, and quality of life. There may be difficulty in comparing surgical procedures because of intentional modifications or variations in technique and the experience and expertise of the surgeon. Therefore, it is difficult to compare outcomes from one type of surgery to another.^{2,41} A more detailed list of the various types of surgeries and their follow-up studies can be found in the 1996 AHCPR guidelines.

When a patient decides to have surgery, he/she must keep in mind the recuperation time and the possible complications involved.^{2,16} Recuperation involves a one- to three-day stay in the hospital, a catheter for two days up to possibly six weeks, activity restrictions, such as no lifting over 20 pounds for six weeks and over 50 pounds for three months, no aerobic exercise for six weeks, and no sexual intercourse for six weeks. Some of the complications following

surgery is an increased risk for urinary tract infection immediately following surgery, urinary urgency or detrusor instability, obstructive voiding problems, self catheterization, or development of new pelvic floor disorders due to scar tissue and nerve denervation from the surgical incisions.

Treatment of urinary incontinence remains a formidable task for the health care community. Great strides have been made for better understanding of the problem and effective treatments. The surgical treatment of this condition will remain an important aspect of urological care for appropriately selected patients who are unable to comply with other nonsurgical therapies.

CHAPTER VI

DISCUSSION

Direct comparisons of physical therapy versus surgical treatment are very rare in the literature.^{7,18} In a study by Klarskov et al,⁴² 50 women with urodynamically proven genuine stress incontinence were randomly treated with surgical or nonsurgical techniques. The nonsurgical group (24 women) received five sessions of pelvic floor muscle rehabilitation supervised by trained physical therapists at weekly intervals. The surgical group (26 women) underwent either a Burch colposuspension or a vaginal repair operation based on the characteristics of their voiding cystourethrograms. Follow up was done at 4 and 12 months and patients who were dissatisfied with their outcome were given the alternative treatment they had not received. Although surgery was significantly better than pelvic floor rehabilitation by both objective and subjective criteria, the pelvic exercise program improved the majority of patients enrolled and 42% of the patients enrolled improved so much that they did not want surgical intervention. Long-term follow up was similar to the short-term results. In another study, 43% of patients using physical therapy were satisfied with their improvement and did not wish to proceed to surgery.⁷ The authors concluded that a supervised pelvic floor training program is a realistic alternative to surgery for mild cases of stress incontinence, and that patients with residual symptoms

after surgery can benefit from the addition of pelvic floor training. It is also conceivable that preoperative physical therapy might enhance surgical outcome, but this issue has not been addressed in the literature.

The AHCPR examined the outcome of stress incontinence treatments and compared rates of “cure,” “improvement,” side effects, and complications of behavioral techniques, pharmacological treatment, and surgical treatment.^{2,7} Table 5 is a compilation of those findings. Although a higher “cure” rate was reported with surgical techniques, a higher rate of “improvement” was found in behavioral therapies. If improvement and cure rates are combined as denoting beneficial treatment, behavioral therapies are comparable with surgical therapies, without the risk or complications of surgery.

Since the available outcomes are averaged from published studies that do not necessarily use the same criteria for benefit and complications, comparisons must be viewed with caution. The question needs to be asked about whether the outcome of “improvement” or “cure” be used. Being completely dry is probably not normal in women. In one study of over 1,000 college women, researchers found that 50% lost small amounts of urine occasionally when they cough or sneeze.⁷ Occasional urine losses after treatment may be defined as “improvement,” but have restored a patient to a more normal state than the woman who is completely dry after an obstructive bladder-neck surgery and now cannot void.

Table 5.—Outcome of Stress Incontinence Treatments

Treatment Options					
	Behavioral technique		Pharmacologic	Surgical technique	
Outcome	Pelvic muscle exercise	Bladder training	Alpha agonist	Retropubic suspension	Needle suspension
Cured	12%	16%	0% - 14%	78%	84%
Improved	75%	54%	19% - 60%	5%	4%
Total	87%	70%	19% - 74%	83%	88%

Side effects
Complications

None
None

Minimal to 20%
5% - 33%

—
20%

Another important factor to consider when choosing a treatment option is the cost involved. The health care system may not be able to support surgery as a first-line treatment for urinary incontinence. Reimbursement for nonsurgical management may be favored over reimbursement for surgical management in the near future since both forms of intervention have similar improvement. The average cost for surgery can range from \$3,900 to \$8,000 according to the AHCPR guidelines, while the average cost of physical therapy treatment for urinary incontinence is \$350 to \$375 for four to six treatments over the course of two to three months.^{43,44} Medication costs can range from \$325 to \$500 based on per incidence or year as appropriate.²

Because of the low risk of side effects, the relatively high success rate, and the lower costs associated with treatment, pelvic floor exercises are usually the first therapy to be tried. It is also important to consider that many busy physicians do not have the time, interest, or patience to teach patients about pelvic floor contractions and closely follow the patients that an enthusiastic physical therapist would do. It is recommended that a set period of therapy should be outlined, usually two to three months, although some studies suggest that the full benefit is not seen until after six months.^{7,16} Much of the benefit of pelvic floor re-education may be increased awareness of the pelvic floor muscles, and this may occur within one week of training. Pelvic floor exercise should be considered lacking benefit only if the patient had been properly instructed and had received close follow up and instruction; otherwise, the failure may well have been in the instruction.

If improvement is insufficient, then medical therapy using pharmacological treatment should be initiated. These drugs may be taken on an “as needed” schedule; therefore, patients may be willing to tolerate some of the side effects associated with the medication on days when continence is especially important, such as being away from the house or traveling. For patients with predictable incontinence, such as stress incontinence, who only lose urine during activity, changing the activities or wearing a pessary device or tampon during the activities may be an acceptable alternative.

The surgeon who is unfamiliar with the success and implementation of nonsurgical treatment options for urinary incontinence cannot give unbiased preoperative counseling. Such a physician is offering only surgical treatment, since the nonsurgical options may either be discouraged or inadequately undertaken. Nonsurgical therapies need to be offered in an effective and encouraging manner such as done by a physical therapist. Many women will be able to improve or cure their stress incontinence with these techniques. Patients who do not receive sufficient benefit from nonsurgical treatment and who ultimately select surgery are not resentful of a limited trial of these therapies. As long as reasonable periods are set for nonsurgical techniques, patients are pleased to have had other options and the chance to help manage their own condition.⁷

Many treatment options exist for treating urinary incontinence. The options made available to patients will largely depend on the interventions offered by the primary health care provider. The interventions can range from

behavioral techniques and pelvic floor re-education, pharmacological treatment, and surgical intervention. According to the AHCPR guidelines, “the least dangerous and least invasive procedure that is appropriate for the patient should be the first choice.” A multidisciplinary team of professionals working together allows for more treatment options and enables patients to receive the most appropriate treatment based on their specific diagnosis. The team members, while specializing in their own area, can also work together to create a care plan which includes those specialties of most benefit to “the patient.” A program proposal to present the multidisciplinary treatment of urinary incontinence can be found in Appendix G.

APPENDIX A

Date	Column 1	Column 2	Column 3	Column 4
Time Interval	Urinated in toilet /amount	Had an incontinent episode/ Was urge present?	Activity associated with incontinent episode	Amount of leakage-small medium,large Changed wet pad?
4-6 am				
6-8 am				
8-10 am				
10-noon				
noon-2 pm				
2-4 pm				
4-6 pm				
6-8 pm				
8-10 pm				
10-midnite				
overnight				

KEEPING A RECORD OF YOUR BLADDER FUNCTION: How to keep your bladder diary.

The main purpose of a bladder diary is to document your bladder functions. A diary can give your healthcare provider an excellent picture of your bladder functions, habits and patterns. The diary is initially used as an assessment tool. Later, it is used to measure your progress. Please complete a bladder diary every day for three-four days and bring them with you to your first appointment.

In the beginning, continue to go about your daily life as normal. You are making a written record of your normal bladder patterns so please avoid making any changes in your bladder routines. Your diary will be much more accurate if you fill it out as you go throughout the day. It can be very difficult to remember at the end of the day exactly what happened in the morning. The diary plays an important part in your healthcare provider's ability to understand your problem and should not be taken lightly.

Also, if possible, remember to change your pad or clothing whenever you feel yourself leaking or notice that you are damp. A dry pad or pair of underwear helps to increase your awareness of problems and improve the accuracy of your record.

Instructions:

- Column 1: Place a U in the box with the appropriate time interval each time you urinate during the day.
- Column 2: Place a check next to the time an incontinent episode occurs. Write yes in the column if urge to urinate was present prior to leakage.
- Column 3: Describe the activity associate with leakage ie cough, heard running water, lifted child.
- Column 4: Note the amount of urinary leakage.
 S- Small = drop or two of urine
 M- Medium = wet underwear
 L- Large = wet outerwear/floor
 Note if pad change was needed, place a P in column.

APPENDIX B

PELVIC FLOOR QUESTIONNAIRE

Name _____
 Physician _____ DATE _____

Please describe your main problem _____

When did it begin? _____ Is it getting: better, worse, or staying the same (circle one)

Please describe activities or things that you cannot do because of your problem. _____

Please list all pelvic and abdominal surgeries with dates of operation _____

Date of last pelvic examination _____ Date of last urinalysis _____
 Special Tests Performed? _____ Type _____ Date _____

1. OCCURENCE OF INCONTINENCE OR LEAKAGE (If this does not apply, skip to question # 7)

Never (6)
 Less than 1/month (5)
 More than 1/month (4)
 Less than 1/week (3)
 More than 1/week (2)
 Almost every day (1)
 More than 1/day # _____ (0)

2. PROTECTION WORN
 No Protection (4)
 Pantishields (3)
 Mini Pad (2)
 Maxi Pad (1)
 Diaper/Serenity (0)

3. SEVERITY

No leakage (3)
 Few drops (2)
 Wet underwear (1)
 Wet outerwear (0)

4. POSITION OR ACTIVITY WITH

LEAKAGE
 Lying down
 Sitting
 Standing
 Changing positions (from sit to stand)
 Intercourse
 Strong Urge

5. HOW LONG CAN YOU DELAY THE NEED TO URINATE?

Indefinitely (6)
 1+ hours (5)
 1/2 hour (4)
 15 minutes (3)
 Less than 10 minutes (2)
 1-2 minutes (1)
 not at all (0)

6. ACTIVITY THAT CAUSES URINE LOSS

Vigorous activity (3)
 Moderate activity (2)
 Light activity (1)
 No activity (0)
 Type _____

7. * PROLAPSE (Falling Out Feeling)

Never (5)
 Occasionally/with menses (4)
 Pressure at the end of the day (3)
 Pressure with straining (2)
 Pressure with standing (1)
 Perineal pressure all day (0)

8. FREQUENCY OF URINATION (DAYTIME)

0 TIMES PER DAY

1-4

5-8

9-12

13+

9. FREQUENCY OF URINATION
(NIGHTTIME)

0 TIMES PER NIGHT

1

2

3

4+

10. FLUID INTAKE

includes water and beverages

9+ 8oz glasses per day

6-8 8oz glasses per day

3-5 8oz glasses per day

1-2 8oz glasses per day

How many caffeinated glasses? _____

11. FREQUENCY OF BOWEL
MOVEMENTS

2 Times per day

1 time per day

every other day

once every 4-7 days

weekly

other

12. AFTER STARTING TO URINATE, CAN YOU COMPLETELY STOP THE URINE
FLOW?

Can stop completely (3)

Can maintain a deflection of the stream (2)

Can partially deflect the urine stream (1)

Unable to deflect or slow the stream (0)

13. DO YOU HAVE TROUBLE INITIATING A URINE STREAM?

Never (3)

More than 1/month (2)

Less than 1/week (1)

Almost every day (0)

14. ATTITUDE TOWARDS PROBLEM

No problem (4)

Minor inconvenience (3)

Slight problem (2)

Moderate Problem (1)

Major Problem (0)

15. CONFIDENCE IN
CONTROLLING YOUR PROBLEM

Complete confidence (3)

Moderate confidence (2)

Little confidence (1)

No confidence (0)

16. Are you sexually active? Yes _____ NO _____
 Are you pregnant or attempting pregnancy? Yes _____ NO _____
 Number of pregnancies? _____ Number of deliveries? _____
 Complications? _____

17. History of or present sexually transmitted diseases? type _____

18. Pain or problems with sexual activity or urination?
 Describe _____

19. Have you ever been taught how to do pelvic floor or Kegel exercises? Yes ___ No ___
 When? _____ By whom? _____

20. How often do you do pelvic floor exercises? _____

21. Any comments or concerns not asked?

APPENDIX C

DIETARY IRRITANTS TO THE URINARY TRACT

Certain foods can contribute to urinary frequency, urgency and discomfort. If bladder symptoms are related to dietary factors, a diet that specifically eliminates the foods that cause problems should bring noticeable relief within 10 days. Once you are feeling better, you can begin to add moderate amounts of problem foods back into your daily diet one at a time. Then, if symptoms reoccur, you will be able to determine the irritant. It is very important to drink lots of water as you add the foods back into your diet. The following foods are acidic and have been shown to be irritating to the bladder. These items should be avoided:

alcoholic drinks	cranberries	apples	grape
apple juice	guava	cantaloupe	lemon juice
carbonate drinks	peaches	chiles, spicy foods	pineapple
coffee	plums	strawberries	tomatoes
vinegar	onions		

Other Possible Bladder Irritants (variable):

Spices (especially hot ones)

All wheat, rye, corn, oats, barley and their derivatives

Grain alcohols

Liquid glucose

All vegetable fats except olive oil

Bean family including ground nuts and coca bean (this means chocolate)

Suggestions/Substitutions That You Can Make In Your Daily Diet:

- Drink enough liquids, especially water. It keeps urine from getting too strong. Concentrated urine can cause bladder urgency, has a foul odor and can cause urinary tract and skin infection.
- Drink coffee that has had the acid removed. KAVA and ROMBAUTS are two brands found in the grocery store.
- Drink herbal teas provided they don't contain a large amount of citrus. Weak tea: Dunk a tea bag in water four times quickly to color the water.
- Drink OVALTINE instead of chocolate drinks.
- Drink fruit juices such as apricot nectar, pear nectar and papaya juice.
- Drink late harvest dessert wines. (low acid content)
- Use fructose as found in SUPEROSE, instead of NutraSweet or Saccharine.
- Substitute carob for chocolate in recipes.
- Use orange or lime peel scrapings for flavor. Do not use the white part of the rind.
- Use pine nuts in place of other nuts.
- Eat breads made with potato flour, soya flour or rice flour.
- Vitamins: vitamin c only calcium ascorbate co-buffered with calcium carbonate. Vitamin E: take in powdered form instead of oil capsules. The only B vitamin to use in B6.

References:

You Don't Have to Live With CYSTITIS! Larrian Gillespie, M.D. Rawson Associates: New York, 1986.

CYSTITIS. The Complete Self-Help Guide. Angela Kilmatin. Warner Books: New York, 1981.

Both of these books have merit in helping further one's understanding of the complexity of cystitis. We do not agree with everything that is in these books, but we feel they provide a basis for understanding how difficult it is to identify the exact cause of your particular system complex.

Information sheet adapted from the University of Washington Department of Urology

APPENDIX D

Bladder Retraining for Urge Incontinence

With urge incontinence you frequently feel a strong uncontrollable urge to urinate. The cause is an oversensitive bladder, which feels full even when it contains a small amount of urine. The bladder contracts unexpectedly and if the pelvic muscles are weak, the urine in the bladder is expelled. Urge incontinence often co-exists with stress incontinence.

The aim of bladder training is to restore the person with urgency and/or urge incontinence to a more normal and convenient pattern of voiding.

When you begin you will need:

- daily diary and pencil
- a clock
- a timer
- determination to stick with it

When you experience an urge to void try to follow these steps:

- FIRST** Stop and stand very still.
Sit down if you can.
Do not move.
You need to stay very still to maintain control.
- COND** Relax.
Take a deep breath and then let it out.
Try to make the urge go away.
- THIRD** Squeeze your sphincter muscles slowly (with moderate, not maximal effort) five or six times to keep from leaking.
Try to distract your thoughts to something other than going to the bathroom.
- ALLY** If the urge returns, repeat the above mentioned techniques to regain control. When you feel the urge go away somewhat, walk normally to the bathroom — do not rush. Void once the urge has subsided.

Bladder Retraining Schedule

Urinate when you first get up in the morning. If you have a hard time making it to the toilet when you get up, squeeze the muscle that holds back your urine before you get out of bed. Then get out of bed and walk SLOWLY to the toilet. Empty your bladder as completely as possible and record amount voided. Now set your timer for _____ hour(s).

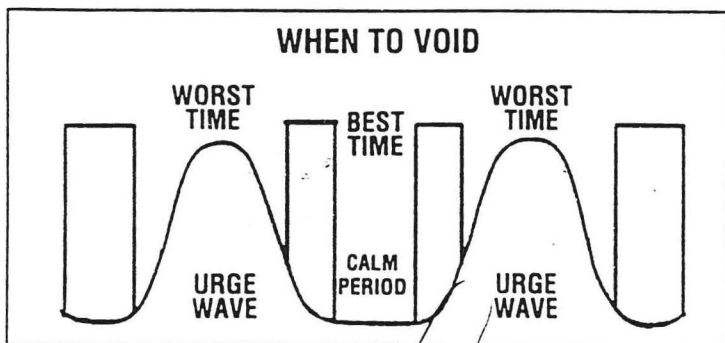
When the timer sounds, go to the toilet, even if you don't feel a need to empty your bladder. Record amount of urine and reset your timer. Continue this throughout the day until you go to bed.

When you have had four-five days without leakage, increase your time interval by 15 minutes.

When you feel the urge to urinate before the timer sounds try to distract yourself by thinking of complex tasks or something especially fun or happy. The feeling that you need to go should pass and you may be able to wait until the timer sounds.

Tips for Success

1. Avoid foods and drinks that irritate your bladder. Alcoholic beverages, coffee, tea, highly spiced foods and cigarette smoking can make problems worse.
2. Drink normal amounts of fluid, including six-eight glasses of water each day.
3. Establish regular bowel habits. If you are constipated, add fiber to your diet.
4. Avoid going to the toilet "just in case." This may turn into a bad habit, and lead to frequent urination.
5. Remember, working with controlling the urge takes time, patience and a positive attitude. Your bladder problems did not happen overnight and they will not be cured overnight — or even in a week or two.



APPENDIX E

Pelvic Floor Muscle Exercises⁷⁴

The pelvic floor muscle strength you develop and maintain is very important in gaining continence of your bladder. These muscles act as a “sling” to keep the bladder and bladder neck supported. They also form the external sphincter. Sometimes these muscles weaken, allowing pelvic organs to drop down. By doing these specific exercises, you can develop stronger, thicker pelvic floor muscles that can help to restore sphincter strength, and, in turn, continence.

BEGIN by locating the muscles that need to be exercised.

1. As you begin urinating, try to stop or slow the urine without tensing the muscles of your legs, buttocks or abdomen. It's important not to use these other muscles, because only the pelvic floor muscles will help with bladder control.
2. When you're able to stop or slow the stream of urine you have located the correct muscles. Feel the sensation of the muscles pulling inward and upward. Do the “stop test” once a week to check your progress. You will become more successful at it as the muscles strengthen.
3. If you're unsure if you're using the correct muscles, you can insert two fingers into the vagina and feel the contraction of these muscles. You can also use a mirror to check your contraction. You should see the rectal sphincter contract and pull in when exercising correctly. If you are a man, rest your hand just in front of the anus. You should be able to feel the muscles tightening up and in. Work hard to do this exercise the right way. Do not move your legs or hold your breath, and keep your stomach muscles relaxed.

4. Remember, it's very important to keep breathing while exercising the pelvic floor. If you have trouble, try counting out loud to keep you from straining or holding your breath. Remember also, not to “bear down” while exercising. Always think of pulling “up and inward” with the pelvic floor. Once you're very comfortable and are gaining strength in your muscles, try contracting up and in during exhalation. This will be challenging!
5. Do both quick, strong “flick” contractions and longer endurance contractions, holding for 5-20 seconds. Do them regularly, 10 times per day. Try to fit them into your daily routine and work up to doing 300 to 400 exercises per day.

A few rules to remember.

1. Do the exercises properly. Remember to keep other muscle groups relaxed and just tighten the pelvic floor.
2. Protect the pelvic floor muscles. Tighten before you cough, sneeze, lift or strain.
3. Keep at it! Once you've improved your bladder control, continue to do the exercises to keep the pelvic floor in good shape.
4. Watch your weight and exercise regularly. Obesity can also contribute to an increase in your incontinence symptoms.

Do the best you can with your exercises and continue faithfully. Your bladder control should continue to improve in three or four weeks. Work hard! As with any exercise program, improvement is related to how faithfully you adhere to your exercise program.



medcenter one.
Physical Therapy Clinic

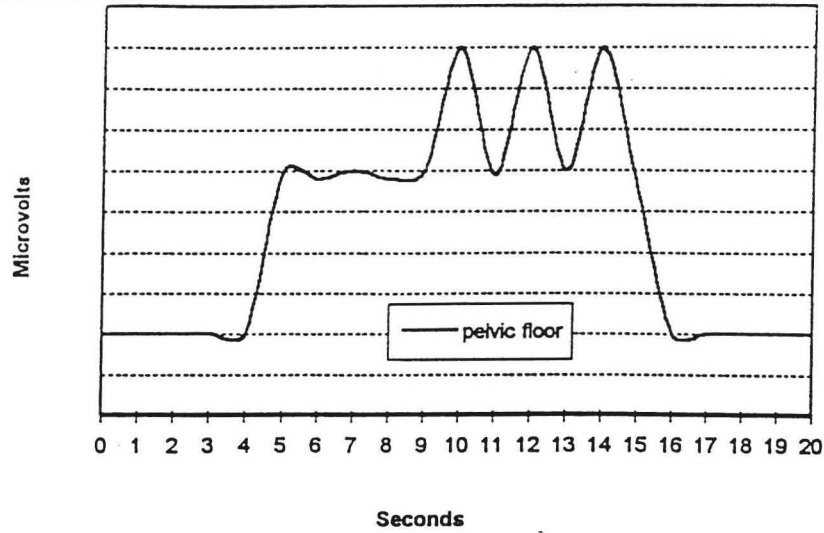
APPENDIX F

XI. Biofeedback assisted Kegel exercise

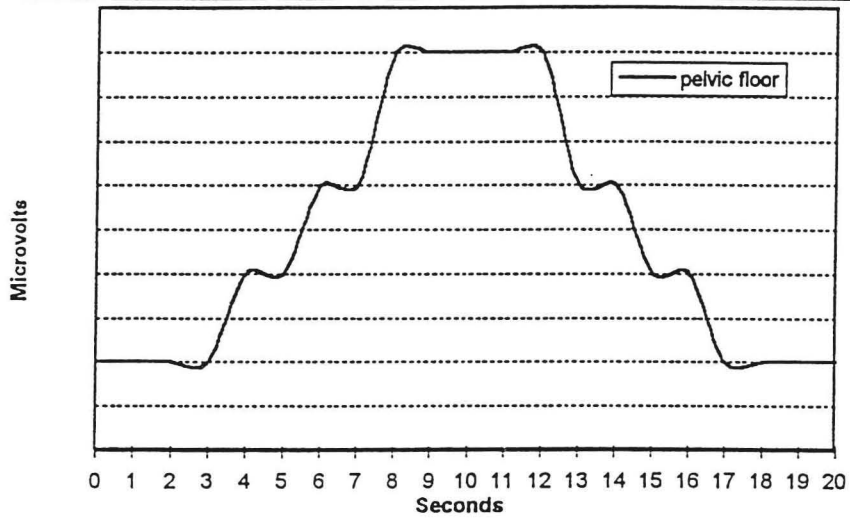
- A. Specific objectives for treating the pelvic floor muscles with SEMG include:
 1. "Uptraining" defined as increasing the activity of a weak muscle (supportive and disuse dysfunctions) with exercise
 - a. Concentric (graph 1)
 - b. Eccentric (graphs 2,4,6)
 - c. Isometric (graphs 2,3)
 - d. Super Kegel (graph 5)
 - e. Combination phasic and tonic training (graph 1) ¹
 2. "Downtraining" defined as decreasing the activity of an overly tense muscle (hypertonus dysfunctions)
 3. Coordination training to facilitate desired synergists and inhibit inappropriate muscle substitution patterns or pathologic synergies. (incoordination dysfunction)
- B. Treatment Considerations
 1. The practitioner should be as attentive to the patient as they are to the biofeedback instrument
 - a. Maximal vs submaximal efforts
 - b. Ability to relax after muscle contractions
 - c. Work / Rest ratio
 - d. Fast fiber training
 - e. Slow fiber training
 - f. Muscle coordination
 - g. Random practice
 - h. Blocked practice
 - i. Pattern Matching
 - j. Use of muscle to decrease urge and frequency symptoms
 - k. Coordination of contraction with regular exercise regimes
 - l. Coordination of exercises with functional tasks that cause symptoms
 - m. Breathing pattern coordination
 2. Home Programs
 - a. Independent exercise program
 - b. Use of rented home equipment
 3. Office
 - a. Re-evaluate and practice home programs for accuracy
 - b. Introduce new exercise regimes

Treatment Suggestions

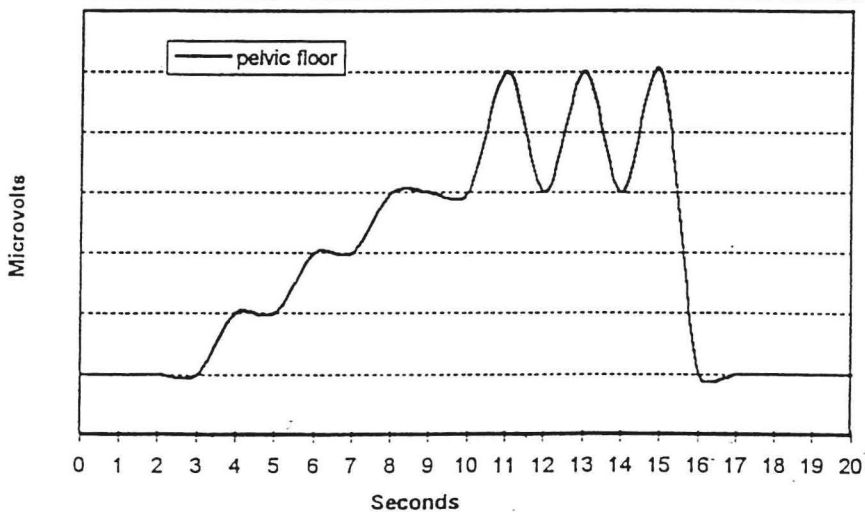
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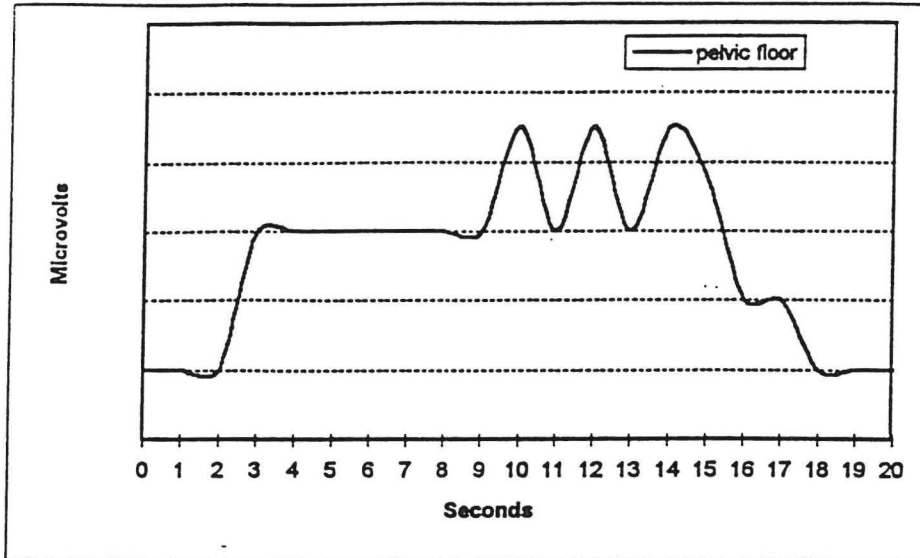


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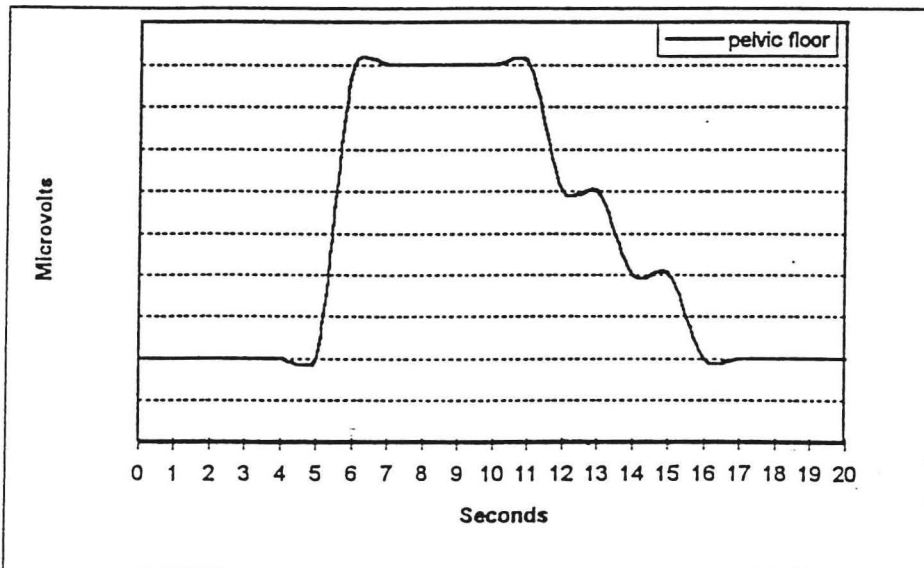
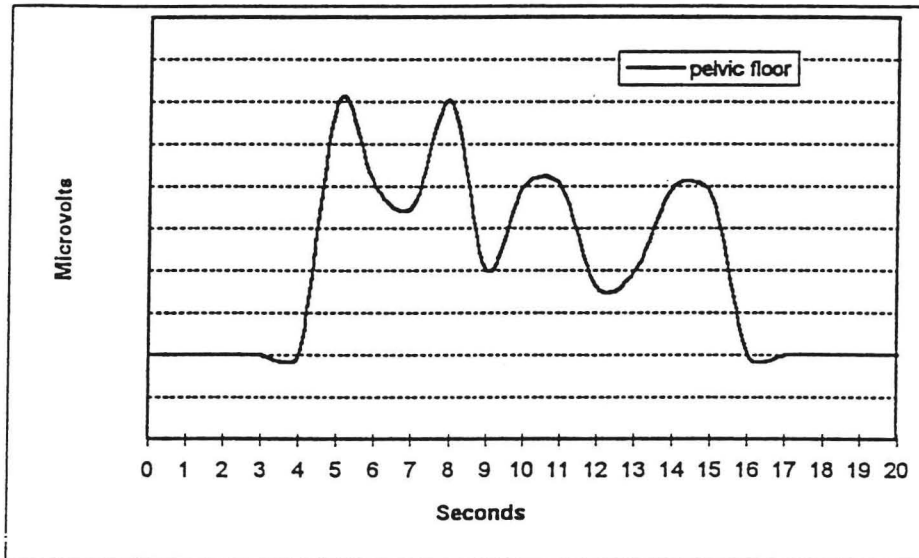


Treatment Suggestions

4



5



APPENDIX G

80
PROGRAM PROPOSAL

FOR

THE TREATMENT OF URINARY INCONTINENCE

Many treatment options exist for treating urinary incontinence ranging from the conservative, behavioral techniques, pelvic floor reeducation, and pharmacological treatments to the non-conservative, surgical intervention. According to the AHCPR guidelines, “the least dangerous and least invasive procedure that is appropriate for the patient should be the first choice.” Physical therapists possess the necessary combined knowledge and skills in kinesiology, electrotherapy, and exercise physiology to conservatively treat problems associated with urinary incontinence.

PHYSICAL THERAPY GOALS FOR INCONTINENCE TREATMENT:

- Describe normal voiding frequency and patterns
- Increase pelvic muscle awareness/isolation
- Demonstrate behavioral techniques to help defer urgency
- Identify bladder irritants and correct fluid intake
- Decrease/Resolve urinary leakage episodes
- Continence for all ADLs, work and recreational activities

Conservative treatments, as performed by a physical therapist has low risk of side effects, a relatively high success rate, and lower costs, and therefore, should be considered the first treatment of choice for urinary incontinence. Reimbursement for nonsurgical management may be favored over reimbursement for surgical management in the near future since both forms of intervention have similar improvement. The average cost for surgery can range from \$3,900 to \$8,000, while the average cost of physical therapy treatment is \$350 to \$375 for four to six treatments over the course of two to three months.

Physical therapists have the skills to provide these services. It is optimal to have a physician as a consultant to assist in medical evaluation and to rule out medical contraindications to conservative treatment.

PHYSICAL THERAPY INTERVENTION:

- Evaluation
 - thorough history
 - bladder diary
 - pelvic floor muscle assessment
 - interpret symptoms (stress, urge, or mixed incontinence)
 - musculoskeletal evaluation and functional testing
- Patient education
 - normal lower urinary tract function
 - dietary fluid management
 - outline behavioral treatments
- Pelvic floor muscle exercise (grade 0-2 muscle strength)
 - neuromuscular reeducation (quick stretch, overflow, proprioception)
 - biofeedback
 - antigravity exercise avoiding use of accessory muscle
 - electrical stimulation with/without EMG trigger
- Pelvic floor muscle exercise (grade 3-5)
 - biofeedback assisted (“uptraining,” “downtraining,” coordination training)
 - functional applications
 - progressive exercise
 - vaginal cones

RESPONSIBILITY OF THE PHYSICAL THERAPIST:

- Desire to work with bowel/bladder dysfunctions
- Continuing education
- Current immunizations
- Knowledge of universal precautions
- Consent of patient for evaluation and treatment
- Physician for consultation and/or referral
- Alliance with professional organizations (e.g. International Continence Society, etc)

ADVANTAGES:

- Patient satisfaction
- Lower cost yet effective
- Low risk/noninvasive
- Patient is a partner in managing own health
- Recommended by AHCPR guidelines

DISADVANTAGES:

- May not work for all patients, but that is also true for surgery
- Patient compliance/cooperation
- Not a “quick fix”

Many treatment options exist for treating urinary incontinence. The options made available to patients will largely depend on the interventions offered by the primary health care provider. A multidisciplinary team of professionals working together allow for more treatment options and enables patients to receive the most appropriate treatment based on their specific diagnosis. The team members while specializing in their own area, can also work together to create a care plan which includes those specialties of most benefit to “the patient.”

REFERENCES

1. North A. The client's view. *Nurs Times*. 1994;90(4):80-82.
2. *Urinary Incontinence in Adults: Acute and Chronic Management*. AHCPR Publication No. 96-0682. Rockville, Md: Public Health Service, Agency for Health Care Policy and Research; March 1996.
3. *Urinary Incontinence in Adults*. National Institutes of Health Consensus Development Conference Statement. 1988;7(5):86-94.
4. Ivy CC. Therapy management of urinary incontinence. *Occu Ther Forum*. 1993;4-10.
5. McIntosh LJ, Frahm JD, Mallett VT, Richardson DA. Pelvic floor rehabilitation in the treatment of incontinence. *J Repro Med*. 1993;38(9):662-666.
6. Brubaker L, Kotarinos R. Kegel or cut? Variations on his theme. *J Repro Med*. 1993;38(9):672-678.
7. Norton PA. Nonsurgical management of stress urinary incontinence. *Contemporary OB/Gyn*. 1992;37:63-78.
8. Wallace K. Female pelvic floor functions, dysfunctions, and behavioral approaches to treatment. *Clin Sports Med*. 1994;13(2):209-231.

9. Frahm J. Strengthening the pelvic floor. *Clin Management in Phys Ther.* 1985;5(3):30-33.
10. King PM, Ling FW, Myers CA. Screening for female urogenital system disease. In: Boissonnault WG. Examination In Physical Therapy Practice. 2nd ed. New York, NY: Churchill Livingstone; 1995.
11. Moore LK. Clinically Orientated Anatomy. 3rd ed. Baltimore, Md: Williams and Wilkins; 1992.
12. Herman H. Urogenital Dysfunction, Clinics in Physical Therapy, Vol 20. Obstetric and Gynecologic Physical Therapy. Wilder E, ed. New York, NY: Churchill Livingstone; 1988.
13. Swash M. Histopathology of the pelvic floor muscles. Coloproctology and the Pelvic Floor. Pathophysiology and Management. Baltimore, Md: Battenworths; 1984.
14. Bent AE, Ostergard DR. Why women are prone to incontinence. *Contemp OB/GYN.* 1984;83-102.
15. DeLancey JO. Anatomy and embryology of the lower urinary tract. *Urogynecol.* 1989;16(4):18-32.
16. Wallace K. Physical Therapy Evaluation and Behavioral Treatment for Urinary Incontinence course notes. June 27-28, 1997. Denver, Colo.
17. van Geelen H. Drug action on the bladder and urethra. *Int Urogynecol J.* 1990;1:19-24.

18. Wall LL, Davidson TG. The role of muscular re-education by physical therapy in the treatment of genuine stress urinary incontinence. *Obstet and Gynecol Surv.* 1992;47(5):322-331.
19. Gregory JG, Purcell MH. Urinary incontinence in the elderly. Ways to relieve it without surgery. *Postgrad Med.* 1986;80(2):253-262.
20. O'Dowd TC. Management of urinary incontinence in women. *Br J Gen Pract.* 1993;43:426-429.
21. McGuire EJ. Stress incontinence: new alternatives. *Int J Fertil.* 1996;41(2):142-147.
22. Koelbl H, Strassegger H, Riss PA, Gruber H. Morphologic and functional aspects of pelvic floor muscles in patients with pelvic relaxation and genuine stress incontinence. *Obstet Gynecol.* 1989;74(5):789-795.
23. Fall M, Lindstrom S. Electrical stimulation: a physiologic approach to the treatment of urinary incontinence. *Urol Clin North Am.* 1991;18(2):393-407.
24. Hubbell DB. A practical guide to urodynamics. *Cont OB/GYN.* 1987;123-140.
25. Ames D, Hastie IR. Medicine in the elderly. Urinary incontinence. *Postgrad Med.* 1995;71:195-205.
26. Bavendam TG. Editorial: Incontinence-lower urinary tract dysfunction and urodynamic evaluations. *J Urol.* 1996;155:286-287.

27. Brink CA, Sampsel CM, Wells TJ, Diokno AC, Gillis GL. A digital test for pelvic muscle strength in older women with urinary incontinence. *Nurs Res.* 1989;38(4):196-199.
28. Kegel AH. Progressive resistance exercise in the functional restoration of the perineal muscles. *AM J Obstet Gynecol.* 1948;56(2):238-248.
29. Tries ML. Kegel exercises enhances by biofeedback. *J Enterostomal Ther.* 1990;17(2):67-76.
30. Kegel AH. Stress incontinence and genital relaxation. A nonsurgical method of increasing the tone of sphincters and their supporting structures. *CIBA Clinical Symposia.* 1952;4:35-51.
31. Newman DK, Smith DA. Pelvic muscle reeducation as a nursing treatment for incontinence. *Urol Nurs.* 1992;12(1):9-15.
32. Wilson PD, Samarra TA, Deakin M, Kolbe E, Brown AD. An objective assessment of physiotherapy for female genuine stress incontinence. *Br J Obstet Gynecol.* 1987;94:575-582.
33. Bo K, Hagen RH, Kvarstein B, Jorgensen J, Larsen S. Pelvic floor muscle exercise for the treatment of female stress urinary incontinence: III. Effects of two different degrees of pelvic floor muscle exercises. *Neurourol Urodyn.* 1990;9:489-502.
34. Burgio KL, Robison JC, Engel BT. The role of biofeedback in kegel exercise training for stress urinary incontinence. *Am J Obstet Gynecol.* 1986;154(1):58-64.

35. Susset JG, Galea G, Reed L. Biofeedback therapy for female incontinence due to low urethral resistance. *J Urol.* 1990;143:1205.
36. Peattie AB, Plevnik S, Stanton SL. Vaginal cones: a conservative method of treating genuine stress incontinence. *Br J Obstet Gynecol.* 1988;95:1049-1053.
37. Bridges N, Denning J, Olah KS, Farrar DJ. A prospective trial comparing interferential treatment and therapy using cones in patients with symptoms of stress incontinence. *Neurourol Urodynam.* 1988;7:267-268.
38. Caputo RM, Benson JT, McClellan E. Intravaginal maximal electrical stimulation in the treatment of urinary incontinence. *J Repro Med.* 1993;38(9):667-671.
39. Bent AE, Sand PK, Ostergard DR, Brubaker LT. Transvaginal electrical stimulation in the treatment of genuine stress incontinence and detrusor instability. *Int Urogynecol J.* 1993;4:9-13.
40. Dumoulin C, Seaborne DE, DeGiradi CQ, Sullivan SJ. Pelvic-floor rehabilitation, part 2: pelvic floor reeducation with interferential currents and exercise in the treatment of genuine stress incontinence in postpartum women-a cohort study. *Phys Ther.* 1995;75(12):1075-1081.
41. Jarvis GJ. Surgery for genuine stress incontinence. *Br J Obstet Gynecol.* 1994;101:371-374.
42. Klarskov P, Belving D, Bischoff N. Pelvic floor exercises versus surgery for female urinary stress incontinence. *Urol Int.* 1986;41:129.

43. Melanie Carvell, A physical therapist practicing in women's health in the state of North Dakota.
44. Arlene Johnson, A physical therapist practicing in women's health in the state of North Dakota.